
User's Manual

Model RAMC Short Stroke ROTAMETER

IM 01R01B02-00E-E

vigilantplant.[™]

YOKOGAWA 

Rota Yokogawa GmbH & Co. KG
Rheinstr. 8
D-79664 Wehr
Germany

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1. Introduction

Before use, read this manual thoroughly and familiarize yourself fully with the features, operations and handling of Rotameter RAMC to have the instrument deliver its full capabilities and to ensure its efficient and correct use.

Notices Regarding This Manual

- This manual should be passed to the end user.
- The contents of this manual are subject to change without prior notice.
- All rights reserved. No part of this document may be reproduced or transmitted in any form or by any means without the written permission of Rota Yokogawa (hereinafter simply referred to as Yokogawa).
- This manual neither does warrant the marketability of this instrument nor it does warrant that the instrument will suit a particular purpose of the user.
- Every effort has been made to ensure accuracy in the contents of this manual. However, should any questions arise or errors come to your attention, please contact your nearest Yokogawa sales office that appears on the back of this manual or the sales representative from which you purchased the product.
- This manual is not intended for models with custom specifications.
- Revisions may not always be made in this manual in conjunction with changes in specifications, constructions and/or components if such changes are not deemed to interfere with the instrument's functionality or performance.

Notices Regarding Safety and Modification

- For the protection and safety of personnel, the instrument and the system comprising the instrument, be sure to follow the instructions on safety described in this manual when handling the product. If you handle the instrument in a manner contrary to these instructions, Yokogawa does not guarantee safety.
- If this instrument is used in a manner not specified in this manual, the protection provided by this instrument may be impaired.
- As for explosionproof model, if you yourself repair or modify the instrument and then fail to return it to its original form, the explosion protected construction of the instrument will be impaired, creating a hazardous condition. Be sure to consult Yokogawa for repairs and modifications.

The following safety symbols and cautionary notes are used on the product and in this manual:



WARNING

This symbol is used to indicate that a hazardous condition will result which, if not avoided, may lead to loss of life or serious injury. This manual describes how the operator should exercise care to avoid such a risk..



CAUTION

This symbol is used to indicate that a hazardous condition will result which, if not avoided, may lead to minor injury or material damage. This manual describes how the operator should exercise care to avoid a risk of bodily injury or damage to the instrument.



IMPORTANT

This symbol is used to call your attention to a condition that must be observed in order to avoid the risk of damage to the instrument or system problems.



NOTE

This symbol is used to call your attention to information that should be referred to in order to know the operations and functions of the instrument.

For Safe Use of Rotameter RAMC



WARNING

- If the process fluid is harmful to personnel, handle Rotameter RAMC carefully even after it has been removed from the process line for maintenance or other purposes. Exercise extreme care to prevent the fluid from coming into contact with human flesh and to avoid inhaling any residual gas.
 - In case of Explosion proof type instrument, further requirements and differences are described in Chapter 10 "EXPLOSION PROTECTED TYPE INSTRUMENTS". The description in Chapter 10 is prior to other descriptions in this instruction manual.
-



CAUTION

- When carrying Rotameter RAMC around, exercise extreme care to avoid dropping it accidentally and causing bodily injury.

Warranty

- The warranty of this instrument shall cover the period noted on the quotation presented to the Purchaser at the time of purchase. The Seller shall repair the instrument free of charge when the failure occurred during the warranty period.
- All inquiries on instrument failure should be directed to the Seller's sales representative from whom you purchased the instrument or your nearest sales office of the Seller.
- Should the instrument fail, contact the Seller specifying the model and instrument number of the product in question. Be specific in describing details on the failure and the process in which the failure occurred. It will be helpful if schematic diagrams and/or records of data are attached to the failed instrument.
- Whether or not the failed instrument should be repaired free of charge shall be left solely to the discretion of the Seller as a result of an inspection by the Seller.

The Purchaser shall not be entitled to receive repair services from the Seller free of charge, even during the warranty period, if the malfunction or damage is due to:

- improper and/or inadequate maintenance of the instrument in question by the Purchaser.
- handling, use or storage of the instrument in question beyond the design and/or specifications requirements.
- use of the instrument in question in a location not conforming to the conditions specified in the Seller's General Specification or Instruction Manual.
- retrofitting and/or repair by an other party than the Seller or a party to whom the Seller has entrusted repair services.
- improper relocation of the instrument in question after delivery.
- reason of force measure such as fires, earthquakes, storms/ floods, thunder/lightning, or other reasons not attributable to the instrument in question.



WARNING

- Rotameter RAMC is a heavy instrument. Please give attention to prevent that persons are injured by carrying or installing. It is preferable for carrying the instrument to use a cart and be done by two or more persons.
 - When removing the instrument from hazardous processes, avoid contact with the fluid and the interior of the meter.
 - In case of Explosion proof type instrument, further requirements and differences are described in Chapter 10 "EXPLOSION PROTECTED TYPE INSTRUMENTS". The description in Chapter 10 is prior to other descriptions in this instruction manual.
-

Restriction on Use of Radio Transceiver



IMPORTANT

Although the transmitter has been designed to resist high frequency electrical noise, if a radio transceiver is used near the transmitter or its external wiring, the transmitter may be affected by high frequency noise pickup. To test for such effects, bring the transceiver in use slowly from a distance of several meters from the transmitter, and observe the measurement loop for noise effects. Thereafter, always use the transceiver outside the area affected by noise.

1.1 Template

Sending an instrument back to service

Installation and operation of the Rotameter RAMC in compliance with this manual is generally trouble-free.

In case a RAMC has to be sent for repairs or checking to our service, please observe the following:

Due to legislation for the protection of the environment and for the safety of our staff, YOKOGAWA may only ship, repair and check sent devices on the condition that this does not constitute any risk to environment and staff.

YOKOGAWA can only process your returned RAMC if you attach a certificate of harmlessness according to the following sample.

If the unit has been in contact with corrosive, poisonous, flammable or water polluting substances, you must,

- ensure that all parts and hollow spaces of the unit are free of these dangerous substances.
- attach a certificate of harmlessness to the returned unit.

Please understand that YOKOGAWA cannot process your returned unit without such a certificate.

1. INTRODUCTION

Receiver : _____ Sender : _____

Delivery Note (for EU-Countries) Date : _____

Ref. REPAIR for serial no. _____

We are sending following type of article
via forwarding agent : Yusen Air ; Raunheim/Frankfurt

Item	Article	Unit Price	Total Price
	Type (MS-Code)	€ _____	€ _____ (nominal value)
	Charges for airworthy packing and delivery FOB		€ _____
	Total value		€ _____
	Value for customs purpose only		€ _____ (current value)
	Gross weight . _____ kg		
	Net weight : _____ kg		
	Customs Tariff No. : _____		
	Country of origin : Federal Republic of Germany		

Delivery note 2-fold accompanies the goods

SPECIMEN Certificate

Company : _____ Address : _____
Department : _____ Name : _____
Telephone : _____ Fax : _____

Der beiliegende Durchflussmesser :

Type : _____ Order- or Serial No. _____

has been operated with following liquids: _____

Because the liquid is ☐ water-endangering ☐ toxic ☐ caustic ☐ flammable
we have

☐ checked, that all cavities in the flowmeter are free from such substances

☐ flushed out and neutralised all cavities in the flowmeter

Please check applicable description

We confirm that there is no risk to man or environment through any residual liquid contained in this flowmeter.

Date : _____ Signature : _____

Company stamp:

Receiver : _____

Sender : _____

PROFORMA INVOICE (for Third-party-Countries)

Date : _____

Ref. REPAIR for serial no. _____

We are sending following type of article
via forwarding agent : Yusen Air ; Raunheim/Frankfurt

Item	Article	Unit Price	Total Price
	Type (MS-Code) _____	€ _____	€ _____ (nominal value)
	Charges for airworthy packing and delivery FOB		€ _____
	Total value		€ _____
	Value for customs purpose only		€ _____ (current value)
	Gross weight . _____ kg		
	Net weight : _____ kg		
	Customs Tariff No. : _____		
	Country of origin : Federal Republic of Germany		

Delivery note 2-fold accompanies the goods

SPECIMEN Certificate

Company : _____
Department : _____
Telephone : _____

Address : _____
Name : _____
Fax : _____

Der beiliegende Durchflussmesser :

Type : _____ Order- or Serial No. _____

has been operated with following liquids: _____

Because the liquid is ☐ water-endangering ☐ toxic ☐ caustic ☐ flammable
we have

☐ checked, that all cavities in the flowmeter are free from such substances

☐ flushed out and neutralised all cavities in the flowmeter

Please check applicable description

We confirm that there is no risk to man or environment through any residual liquid contained in this flowmeter.

Date : _____ Signature : _____

Company stamp:

1.2 ATEX Documentation

This procedure is only applicable to the countries in European Union.

GB

All instruction manuals for ATEX Ex related products are available in English, German and French. Should you require Ex related instructions in your local language, you are to contact your nearest Yokogawa office or representative.

DK

Alle brugervejledninger for produkter relateret til ATEX Ex er tilgængelige på engelsk, tysk og fransk. Skulle De ønske yderligere oplysninger om håndtering af Ex produkter på eget sprog, kan De rette henvendelse herom til den nærmeste Yokogawa afdeling eller forhandler.

I

Tutti i manuali operativi di prodotti ATEX contrassegnati con Ex sono disponibili in inglese, tedesco e francese. Se si desidera ricevere i manuali operativi di prodotti Ex in lingua locale, mettersi in contatto con l'ufficio Yokogawa più vicino o con un rappresentante.

E

Todos los manuales de instrucciones para los productos antiexplosivos de ATEX están disponibles en inglés, alemán y francés. Si desea solicitar las instrucciones de estos artículos antiexplosivos en su idioma local, deberá ponerse en contacto con la oficina o el representante de Yokogawa más cercano.

NL

Alle handleidingen voor producten die te maken hebben met ATEX explosiebeveiliging (Ex) zijn verkrijgbaar in het Engels, Duits en Frans. Neem, indien u aanwijzingen op het gebied van explosiebeveiliging nodig hebt in uw eigen taal, contact op met de dichtstbijzijnde vestiging van Yokogawa of met een vertegenwoordiger.

SF

Kaikkien ATEX Ex -tyyppisten tuotteiden käyttöohjeet ovat saatavilla englannin-, saksan- ja ranskankielisinä. Mikäli tarvitsette Ex -tyyppisten tuotteiden ohjeita omalla paikallisella kielellänne, ottakaa yhteyttä lähimpään Yokogawa-toimistoon tai -edustajaan.

P

Todos os manuais de instruções referentes aos produtos Ex da ATEX estão disponíveis em Inglês, Alemão e Francês. Se necessitar de instruções na sua língua relacionadas com produtos Ex, deverá entrar em contacto com a delegação mais próxima ou com um representante da Yokogawa.

F

Tous les manuels d'instruction des produits ATEX Ex sont disponibles en langue anglaise, allemande et française. Si vous nécessitez des instructions relatives aux produits Ex dans votre langue, veuillez bien contacter votre représentant Yokogawa le plus proche.

D

Alle Betriebsanleitungen für ATEX Ex bezogene Produkte stehen in den Sprachen Englisch, Deutsch und Französisch zur Verfügung. Sollten Sie die Betriebsanleitungen für Ex-Produkte in Ihrer Landessprache benötigen, setzen Sie sich bitte mit Ihrem örtlichen Yokogawa-Vertreter in Verbindung.

S

Alla instruktionsböcker för ATEX Ex (explosionssäkra) produkter är tillgängliga på engelska, tyska och franska. Om Ni behöver instruktioner för dessa explosionssäkra produkter på annat språk, skall Ni kontakta närmaste Yokogawakontor eller representant.

GR

Όλα τα εγχειρίδια λειτουργίας των προϊόντων με ATEX Ex διατίθενται στα Αγγλικά, Γερμανικά και Γαλλικά. Σε περίπτωση που χρειάζεστε οδηγίες σχετικά με Ex στην τοπική γλώσσα παρακαλούμε επικοινωνήστε με το πλησιέστερο γραφείο της Yokogawa ή αντιπροσωπο της.

SK

Všetky návody na obsluhu pre prístroje s ATEX Ex sú k dispozícii v jazyku anglickom, nemeckom a francúzskom. V prípade potreby návodu pre Ex-prístroje vo Vašom národnom jazyku, skontaktujte prosím miestnu kanceláriu firmy Yokogawa.

CZ

Všechny u•ivatelské p•íru•eky pro v•ýrobky, na ni• se vztahuje nev•ýbušné schv•lení ATEX Ex, jsou dostupné v angli•tiní, níměiní a francouzštiní. Po•adujete-li pokyny týkající se v•ýrobků s nev•ýbušným schv•lením ve vašem lokálním jazyku, kontaktujte prosím vaši nejbli•ší reprezenta•ní kancelář Yokogawa.

LT

Visos gaminiø ATEX Ex kategorijos Eksploatavimo instrukcijos teikiami anglø, vokie•iø ir prancūzø kalbomis. Norėdami gauti prietaisø Ex dokumentacijà kitomis kalbomis susisiekite su artimiausiu bendrovės “Yokogawa” biuru arba atstovu.

LV

Visas ATEX Ex kategorijas izstrādājumu Lietošanas instrukcijas tiek piegādātas angļu, vācu un franču valodās. Ja vēlaties saņemt Ex ierīšu dokumentāciju citā valodā, Jums ir jāsazinās ar firmas Jokogava (Yokogawa) tuvāko ofisu vai pārstāvi.

EST

Kõik ATEX Ex toodete kasutamishendid on esitatud inglise, saksa ja prantsuse keeles. Ex seadmete muukeelse dokumentatsiooni saamiseks pöörduge lähima lokagava (Yokogawa) kontori või esindaja poole.

PL

Wszystkie instrukcje obsługi dla urządzeń w wykonaniu przeciwwybuchowym Ex, zgodnych z wymaganiami ATEX, dostępne s¹ w języku angielskim, niemieckim i francuskim. Jeżeli wymagana jest instrukcja obsługi w Państwa lokalnym języku, prosimy o kontakt z najbliższym biurem Yokogawy.

SLO

Vsi predpisi in navodila za ATEX Ex sorodni pridelki so pri roki v angliš•ini, nemš•ini ter francoš•ini. •e so Ex sorodna navodila potrebna v vašem tukejnjem jeziku, kontaktirajte vaš najbliži Yokogawa office ili predstavnika.

H

Az ATEX Ex mőszerek gépönyveit angol, német és francia nyelven adjuk ki. Amennyiben helyi nyelven kéri az Ex eszközök leírásait, kérjük keressék fel a legközelebbi Yokogawa irodát, vagy képviselőtet.

M

not yet available

1.3 General description

This manual describes installation, operation and maintenance of the RAMC. Please read it carefully before using this device.

Further, please note that customer features are not described in this manual. When modifying specifications, construction or parts, this manual is not necessarily revised unless it can be assumed that these changes will impair RAMC functions or performance.

All units are thoroughly tested before shipping. Please check the received units visually to ensure that they have not been damaged during transport. In case of defects or questions please contact your nearest YOKOGAWA service centre or sales office. Please describe any defect precisely and indicate model code as well as serial number.

YOKOGAWA refuses any liability for units which have been repaired by the user without prior consent and do not meet the specifications as a consequence.

1.4 Principle of measurement

The RAMC is a Variable Area Flow Meter for volume and mass measurements of gases and liquids.

A float, whose movement is nearly independent of viscosity is guided concentrically in a specially shaped cone.

The position of the float is transferred magnetically to the indicator, which shows the measurement values by a pointer on a scale. The indicator can be equipped with limit switches and an electronic transmitter.

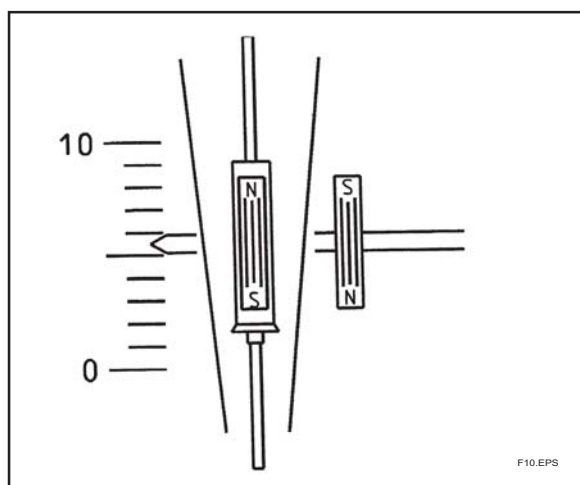


Fig. 1-1

All units are calibrated with water by the manufacturer. By adjusting the calibration values to the measured substance's state of aggregation (density, viscosity), the flow rate scale for each measuring tube can be determined.

Indication units can be exchanged without impairment of precision. However, the scale for the tube must be mounted on the new indicator (and in case of an electronic transmitter the calibration EEPROM, too).

1.5 Overview

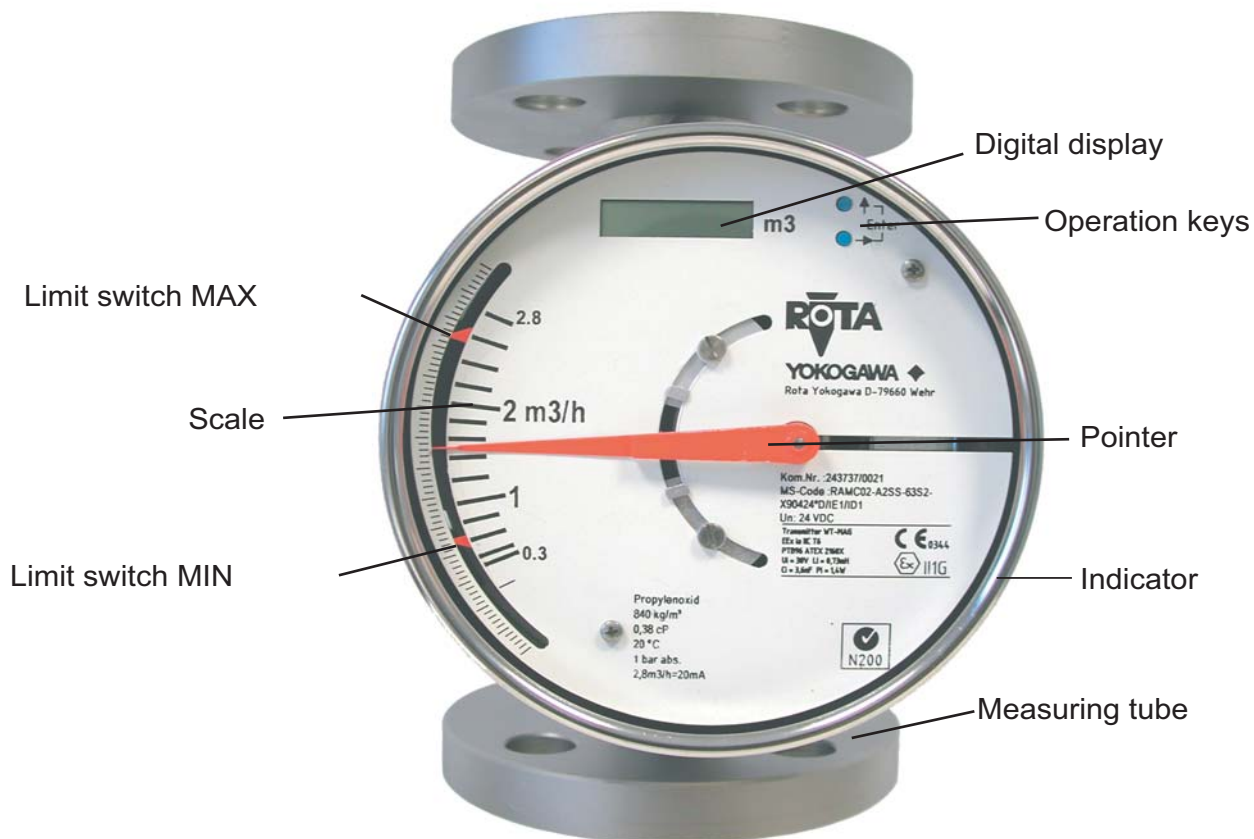


Fig. 1-2

Explanations of specifications on flanges

- type of flange e.g. DIN
- size of flange e.g. DN15
- Pressure range of flange and measuring tube e.g. PN40
- Material of wetted parts e.e. 1.4571
- Manufacturing code of flange manufacturer
- Lot. No.

1. INTRODUCTION

Scale examples

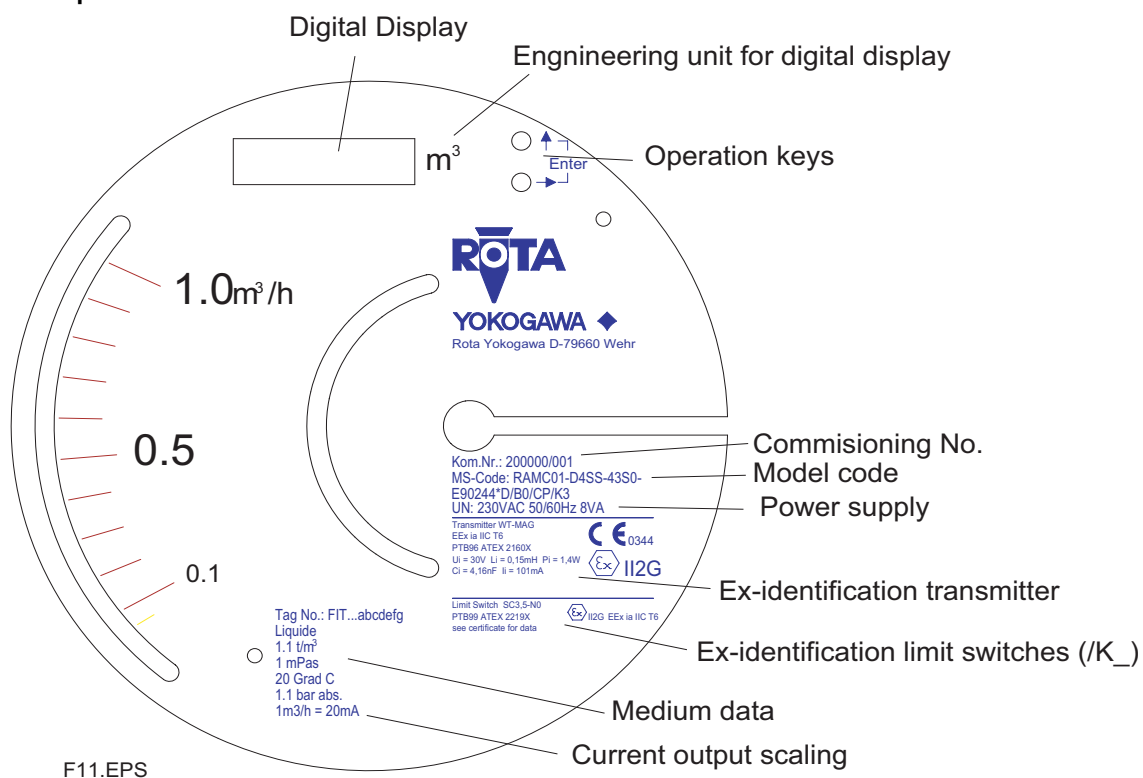


Fig. 1-3 Scale example for -E / -H-type (electronic transmitter)

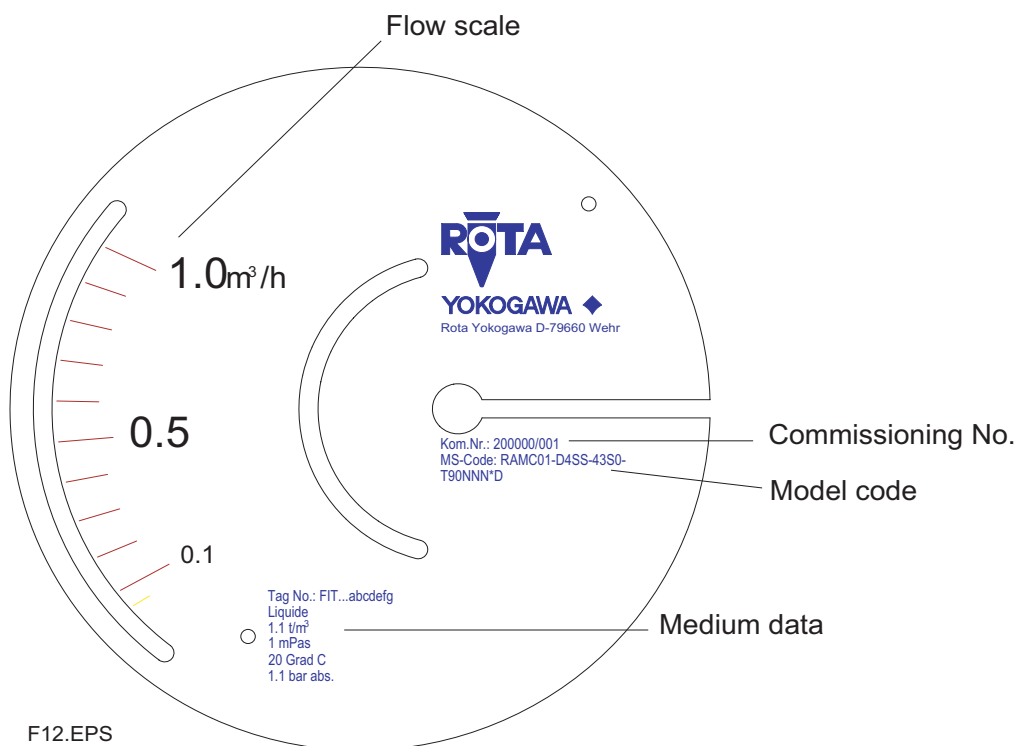


Fig. 1-4 Scale example for -T -type

2. Precautions

2.1 Transportation and storage

Before transporting the unit, it is recommended to fix the float with a card-board strip in the same way as when shipped from factory. Prevent foreign objects from entering the tube (e.g. by covering openings). To protect the unit and especially the tube's interior from soiling, store it only at clean and dry locations

2.2 Installation

Ambient temperature and humidity of the installation location must not exceed the specified ranges. Avoid locations in corrosive environments. If such environments are unavoidable, ensure sufficient ventilation. Although the RAMC features a very solid construction, the instrument should not be exposed to strong vibration or impact stress.

Please note that the RAMC's magnetic sensing system can be influenced by external inhomogeneous magnetic fields (such as solenoid valves). Alternating magnetic fields ($\geq 10\text{Hz}$) as well as homogeneous, static magnetic fields (in the area of the RAMC), like the geomagnetic field have no influence. Asymmetric ferromagnetic bodies of considerable mass (e.g. steel girders) should be kept at a distance of at least 250 mm from the RAMC.

To avoid interference, the distance between two adjacent RAMCs must be at least 300 mm.

2.3 Pipe connections

Ensure that the bolts of the flanges are tightened properly and that the gaskets are tight. Do not expose the unit to pressures higher than the indicated maximum operating pressure (refer to specifications).

While the system is pressurized the flange bolts must not be tightened or loosened.

2. PRECAUTIONS

3. Installation

3.1 Installation in the pipeline

Be sure to remove the transport lock card-board strip from the measuring tube. Check that no cardboard remains in the tube.

The RAMC flow rate meter must be installed in a vertical pipeline, in which the medium flows upwards. The vertical position has to be checked at the outer edge of the flanges. Bigger nominal diameters (DN80/DN100) require straight pipe sections of at least 5D in front and behind the RAMC.

The nominal diameter of the RAMC should correspond to the nominal diameter of the pipeline.

To avoid stress in the connecting pipes, the connecting flanges must be aligned in parallel and axial direction. Bolts and gaskets have to be selected according to the maximum operating pressure, the temperature range and corrosion conditions. Centre gaskets and tighten nuts with a torque appropriate for the pressure range.

If contamination or soiling of the RAMC is to be expected, a bypass should be installed to allow the removal of the instrument without interruption of the flow.

Please read also chapter 2-2. For further instructions on installation please refer to VDI/VDE3513.

3.2 Wiring of electronic transmitter (-E, -H) and limit switches (/K_)

Please regard the drawings on the following pages.

On the rear of the RAMC are two cable glands for round cables with a diameter of 6 to 9 mm (not for Ex-d-type option /KF1). Unused glands must be closed with a blind plug M16x1.5.

For wiring of RAMC with option /KF1 see chapter 10.6.2

Wires should not be bent directly at terminal screws. Do not expose wires to mechanical pressure. Wires must be arranged according to common installation rules, especially signal and power lines must not be bundled together.

The RAMC terminals accept wires with a maximum sectional area of 1.5 mm².

Measuring and indicating instruments, connected in series to the output of the electronic transmitter, must not exceed a load impedance of

$RL = (U - 13.5 \text{ V}) / 20 \text{ mA}$ — for 2-/3-wire RAMCs or 500 Ω for 4-wire RAMCs.

2- or 3-wire units are connected to the terminals marked “+”, “-” and “A” of the power connector.

For 2-wire instruments the terminals “-” and “A” have to be shorted with a jumper. Take care not to loose that jumper when mounting wires.

Wiring inside the case should be kept as short as possible to avoid that moving parts are blocked.

Attention: Hints for Unit Safety (according DIN EN 61010)

- Heed the nominal voltage indicated on the scale.
- The electrical connections have to be executed according to VDE0100 “Errichten von Starkstromanlagen mit Nennspannungen bis 1000 V” (Installation of high current assemblies with nominal voltages of up to 1000 V) or equivalent national regulations.
- For units with a nominal voltage of 115 V or 230 V the correspondingly marked terminal has to be connected to protective earth (PE).
- Units with a nominal voltage of 24 V may only be connected to a protected low voltage circuit (SELV-E according to VDE0100/VDE 0106 or IEC 364/IEC 536).
- The RAMC housing must be grounded to ensure electro-magnetic interference protection. This can be done by grounding the pipeline.
- This unit does not include a power switch. Therefore, a switch has to be prepared at the installation location in the vicinity of the unit. The switch should be marked as the power separation switch for the RAMC.

3. INSTALLATION

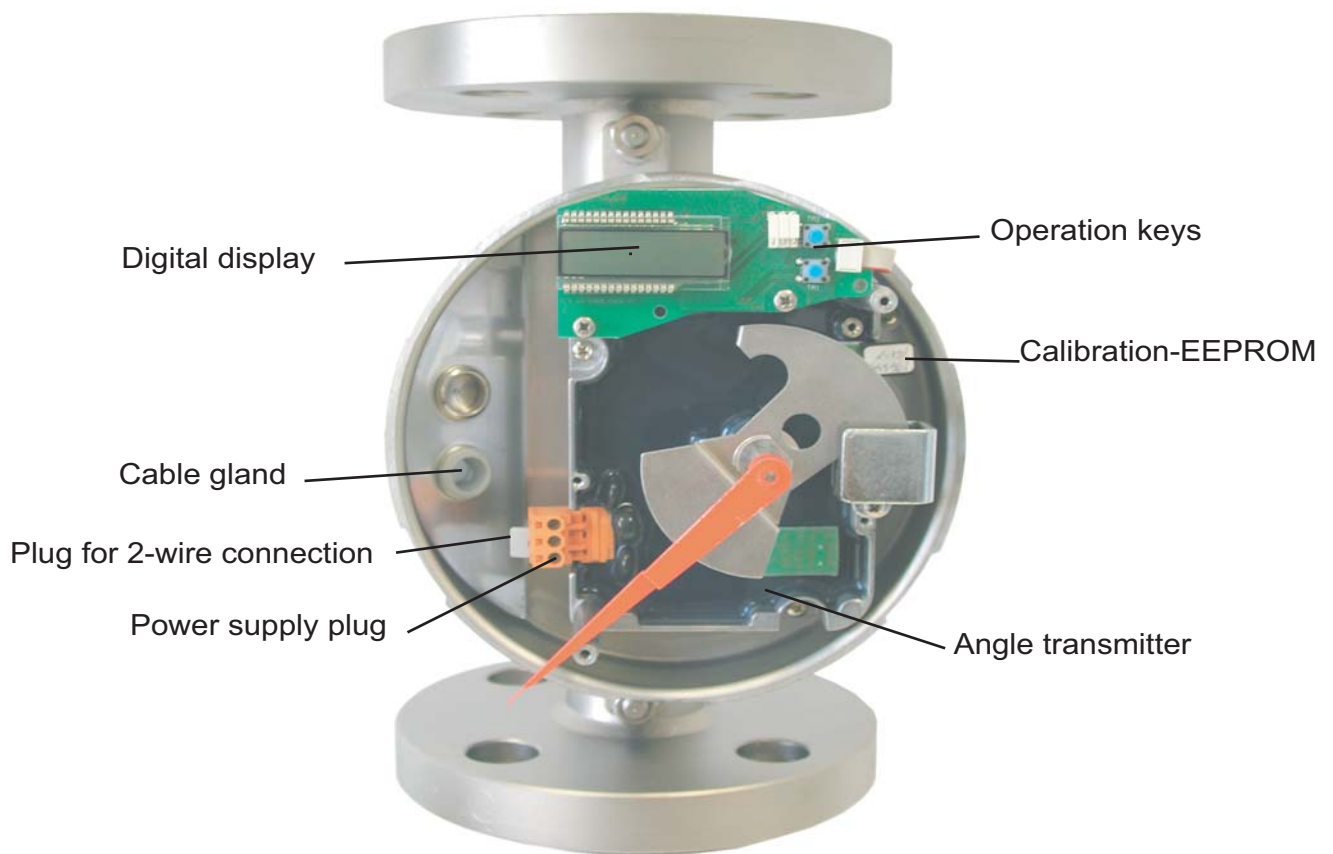


Fig. 3-1 2-wire unit

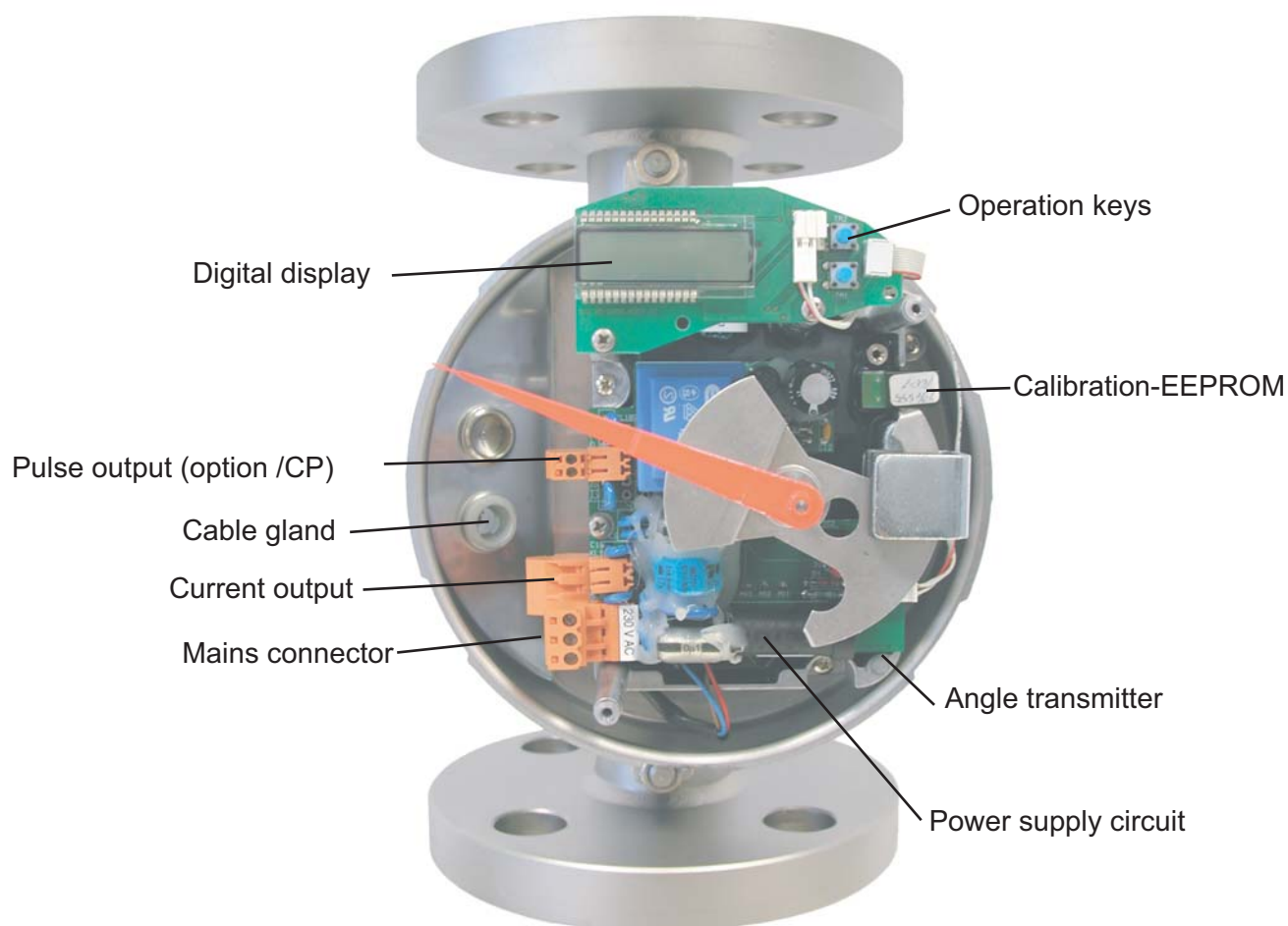


Fig. 3-2 4-wire unit

3. INSTALLATION

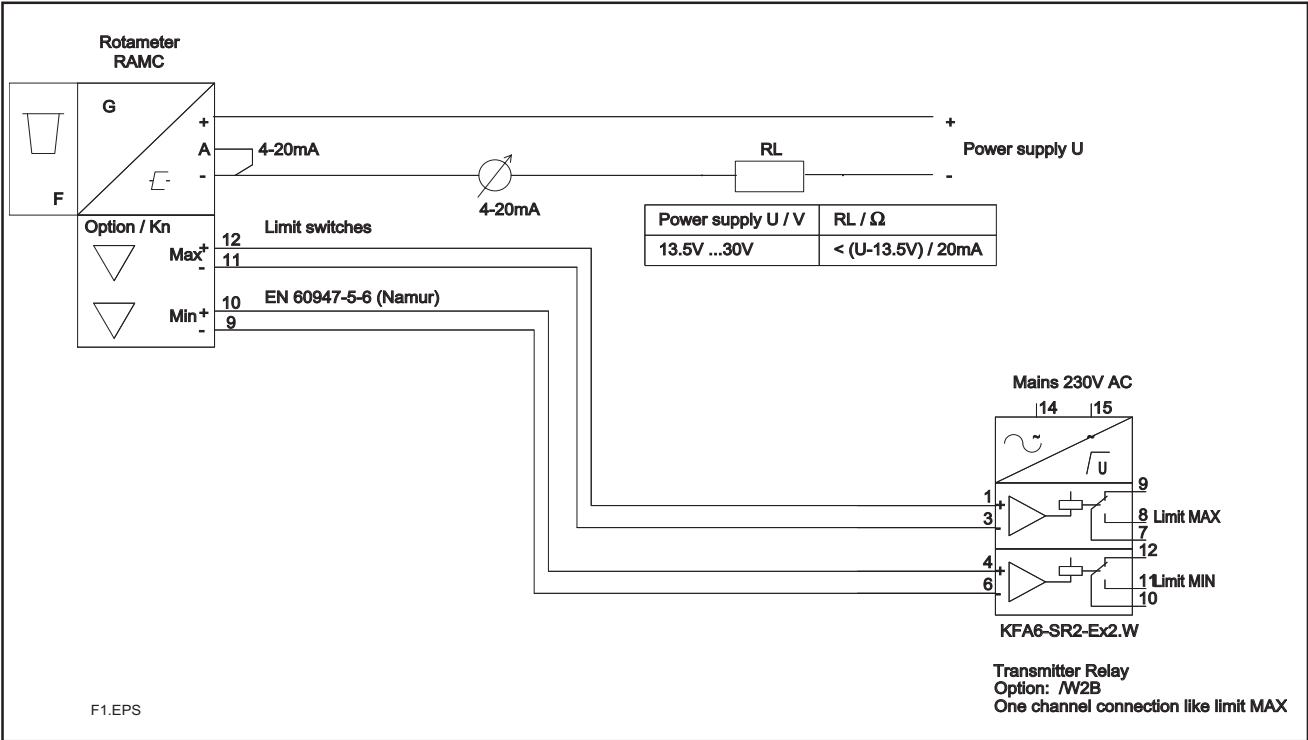


Fig. 3-3 RAMC 2-wire unit with limit switches and transmitter relay

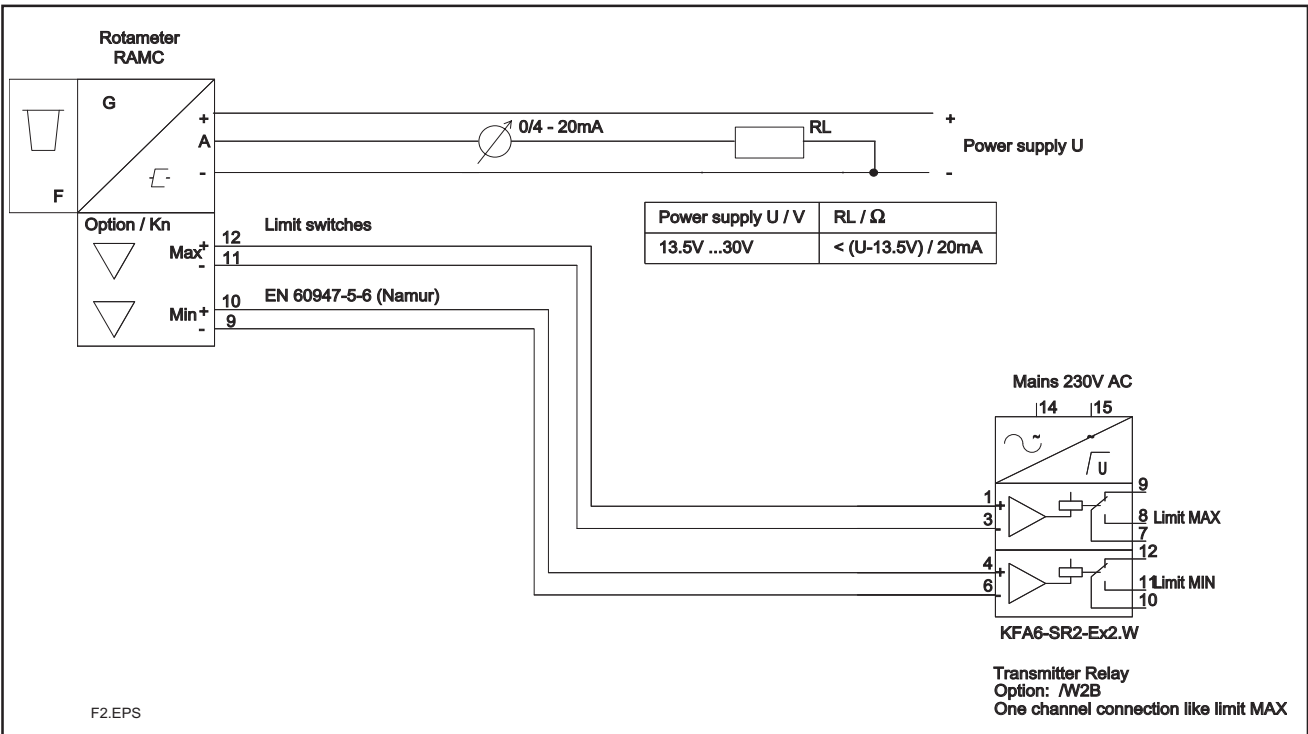


Fig. 3-4 RAMC 3-wire unit with limit switches and transmitter relay

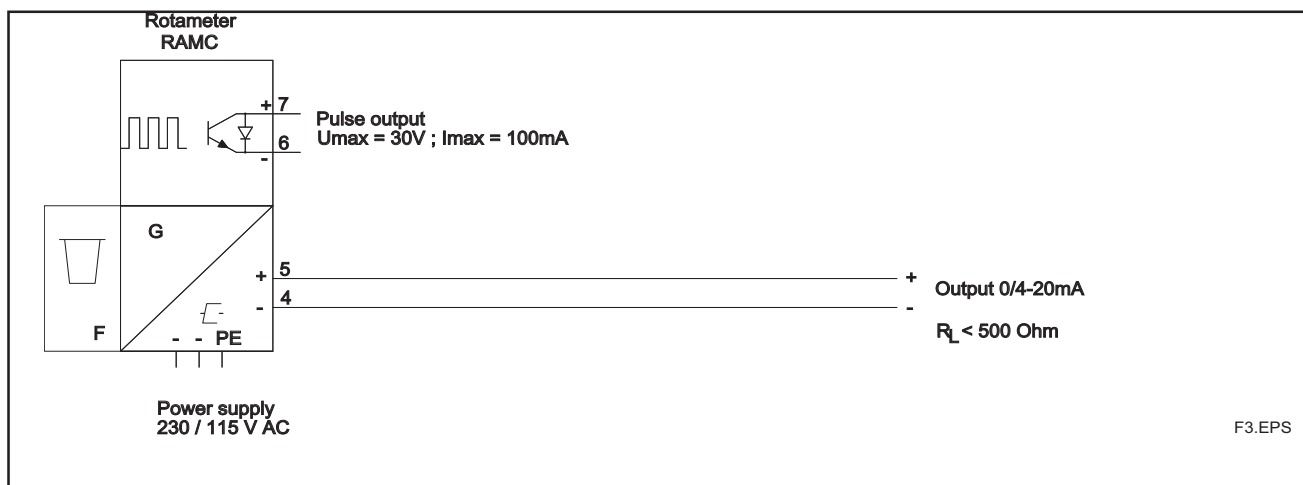


Fig. 3-5 RAMC 4-wire unit with pulse output

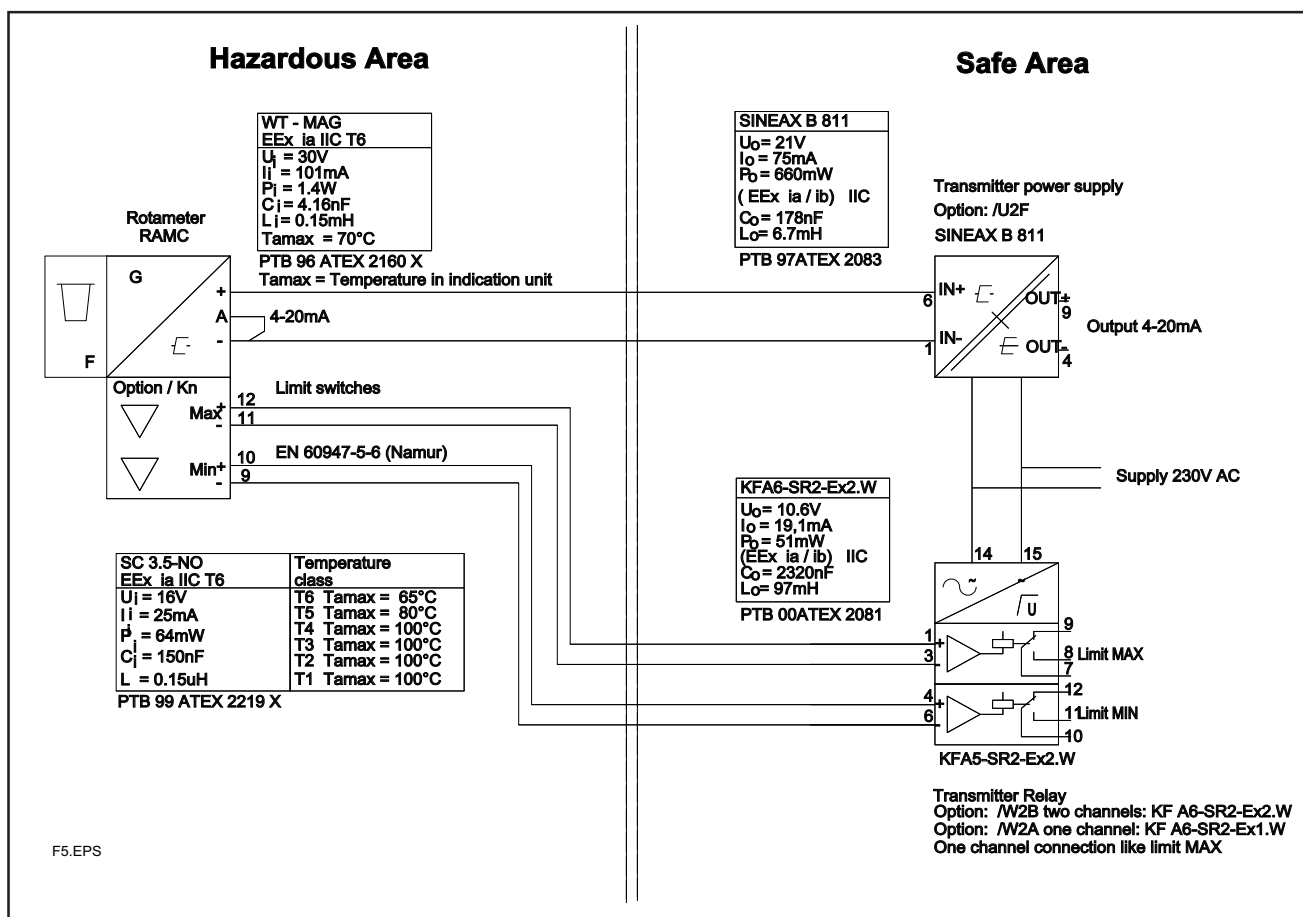


Fig. 3-6 Ex-version acc. to ATEX (Option /KS1) : RAMC 2-wire unit with power supply, limit switches and transmitter relay

3. INSTALLATION

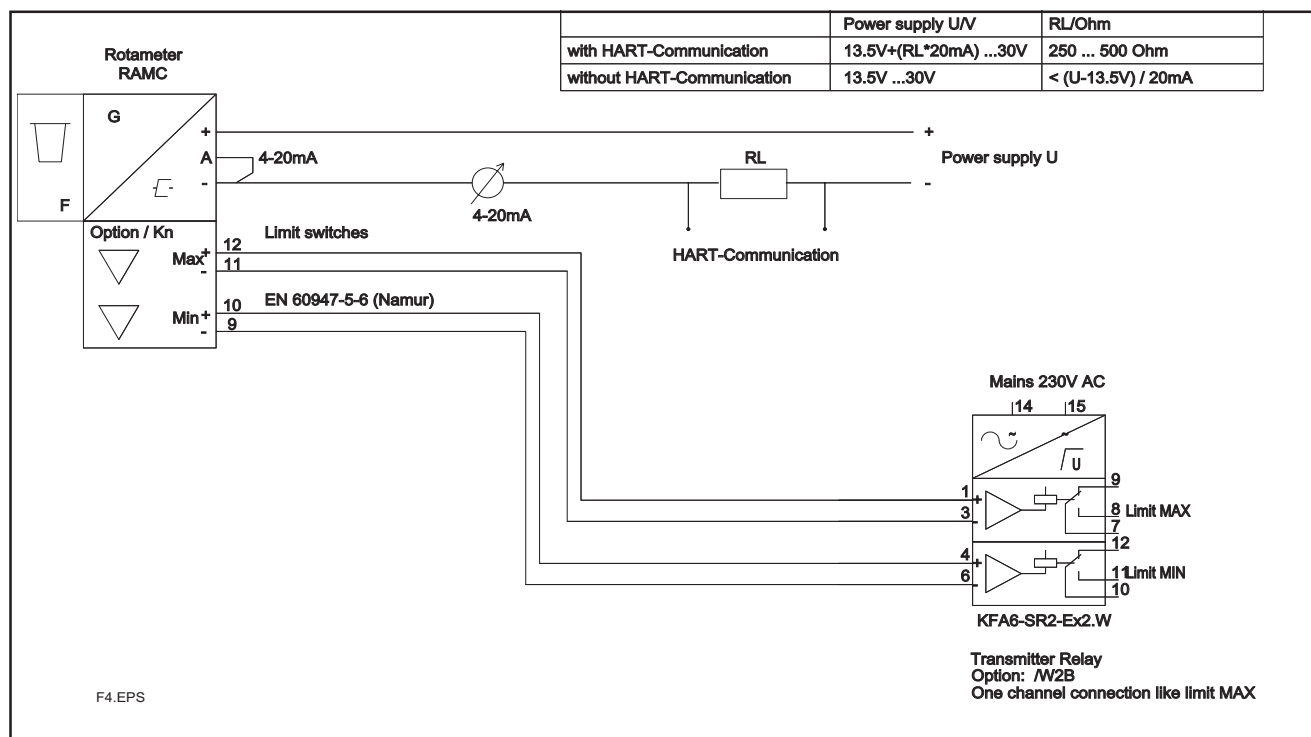


Fig. 3-7 RAMC 2-wire unit with HART-communication, with limit switches and transmitter relay

4. Start of operation

4.1 Hints on flow rate measurement

The measured fluid should neither consist of a multi-phase mixture nor contain ferrite ingredients or large solidmass particles.

The RAMC scale is adjusted to the state of operation/aggregation of the measured fluid by the manufacturer. If the state of operation changes, it might become necessary to establish a new scale. This depends on several factors:

- If the RAMC is operated in the given viscosity independent range, only the density of the float as well as the operational density of the previous and new substance have to be considered. In case the operational density only changes marginally ($\leq 0.5\%$), the present scale can be used.
- If the RAMC is operated outside the given viscosity independent range, the viscosities at the previous and new state of operation as well as the mass and diameter of the float have to be taken into account. To establish a new scale, please refer to the folder "Anweisung zur Skalenumrechnung" (Instructions for Scale Conversion) as well as the conversion table or order a new scale.

4.2 Pulsation and pressure shock

Pressure shock waves and pulsating flow influence measurement considerable or can destroy the meter.

Surge conditions should be avoided. (→ open valves slowly, raise operating pressure slowly)

If float bouncing occurs in gases increase the line pressure until the phenomena stop. If this is not possible provide the float with a damper. A damping kit is available as spare part.

4.3 Start of operation of electronic transmitter

Ensure that the device has been connected correctly according to section 3-2 and that the used power supply meets the requirements indicated on the scale.

Switch on the power supply.

The digital display gives the totalizer value in the measuring unit, indicated on the right side of the display.

The RAMC is now ready for operation.

Unit graduation, measuring unit, damping, etc. can be adjusted by an operating menu (refer to section 6.2). In case of an error, the bars beneath the 8 digits of the display will flash. The corresponding error message can be checked using the operating menu and then taking the appropriate counter measures (refer to section 6-2-8 "Error Messages").

The transmitter has been prepared and calibrated according to the model code as a 2-, 3- or 4-wire unit.

In 2-wire units, a jumper connects "A" and "-". When switching from a 2- to a 3-wire configuration, this jumper should be removed. The current output should then be adjusted as explained in section 6-2-6.

When changing from a 3- to 2-wire configuration, the jumper should be set in place, and the current output has to be adjusted according to section 6-2-6.

4. START OF OPERATION

5. Limit switches (Option /Kn)

The optional limit switches are available as maximum or minimum type switches. They are proximity switches according to EN 60947-5-6 (NAMUR). Maximal two switches can be installed. The option (/Wnn) includes the respective transmitter relay.

These switches have been specified for hazardous area. However, the transmitter relay has to be installed outside any hazardous area.

The limit switches are connected to the transmitter relays as indicated in section 3-2.

The terminals for the limit switches are on a small board on top of the transmitter case.

The MIN-MIN and MAX-MAX functions (refer to option /K3) have been integrated at the factory as MIN-MAX switches in the RAMC. The MIN-MIN or MAX-MAX function is set by adjusting the switching direction of the transmitter relay. The following table shows the assignment:

Function		Switching direction of transmitter relay	
Channel 1	Channel 2	Channel 1	Channel 2
MIN	MAX	normal	normal
MIN	MIN	normal	inverted
MAX	MAX	inverted	normal

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Note: switching direction “normal” means : inversion “OFF”

“inverted switching” means : inversion “ON”.

When using limit switches as a safety option, the switching directions for all combinations should be set to normal (inversion “OFF”) on the transmitter relay.

To ensure functional safety the transmitter relay has to be applied as protection technology.

Please notice chapter 9.3 "Standard specifications".

For questions regarding protection technology, please consult your YOKOGAWA service centre.

5. LIMIT SWITCHES (OPTION /KN)

6. Electronic Transmitter (-E)

6.1 Operation principle

The position of the float is magnetically transferred to a magnetic follow up system. The position angle of this magnetic rocker is detected by magnet sensors. A micro controller determines the angle by means of a combining reference value table in the memory and calculates the flow rate by the angle with calibration and operation parameters the calibration EEPROM. The flow rate is given as a current, either 0-20 mA or 4-20mA, and, in addition, indicated on the digital display (refer also to section 6-2). The electronic transmitters have been electronically calibrated before shipping and, therefore, are mutually exchangeable.

Calibration data of the metering tube as well as customer specific data are entered into a calibration EEPROM, inserted on the board. This calibration EEPROM and the indication scale are assigned to the respective metering tube.

When replacing an indicator (e.g. because of a defect) the scale and calibration EEPROM of the old unit have to be inserted in the new unit. Then, no calibrations or adjustments are necessary.

If an indicator with electronic transmitters is installed to a new metering tube, the calibration EEPROM of that tube has to be inserted into the transmitter and the indicator scale for that particular tube has to be mounted.

A change in the fluid data (e.g. specific gravity, pressure, etc.) requires the preparation and mounting of a new calibration EEPROM and scale.

Normally the range of the current output is equal to the rounded measuring range of the tube (end value on scale). The customer can position the 20 mA point between 60% and 100% of the end value on scale. The set of the 20 mA point is shown on the scale (refer to Fig. 1-4). The flow cut off is positioned at 5% of the end value.

Below 5% flow the current output shows 0 mA (4 mA).

6.2 Parameter setting

The displays allows indication of various parameters:

- Flow rate (8 mass or volume units in combination with 4 time units)
- Counter (8 mass or volume units)
- Flow rate indication in percent
- Special functions:
- Setting of different damping times
- Switching of current output 0-20 mA / 4-20 mA or vice versa
- Indication of error messages
- Manual calibration
- Service functions
- Detection of float blockage

The setting of these parameters is done by two buttons.

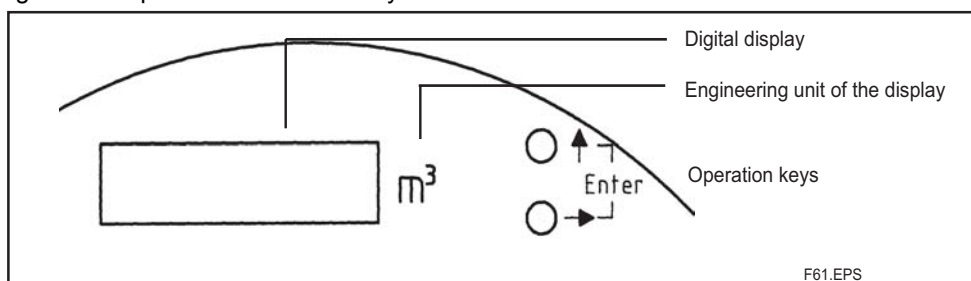


Fig. 6.1 Operation keys

6. ELECTRONIC TRANSMITTER (-E)

The buttons access three functions:

- upper button (\uparrow) : Exit setting mode
- lower button (\rightarrow) : Scroll through menu/selection of parameters
- both buttons (\uparrow + \rightarrow) = Enter : Entering parameters/selecting setting mode

If no button is pressed for one minute while the operating menu is active, the indication reverts to the measuring indication. This does not apply to subfunctions F32, F33, F52, F63.

For indication of volume or mass values at maximum 6 digits in front of the decimal point and 7 decimals are used. This format allows an indication range for flow rates from 0.0000001 uni/time to 106000 unit/time. Flow rate values exceeding 106000 are shown as '————' on the display. In this case the next bigger flow rate unit (next smaller time unit) has to be selected.

For the indication of totaliser values 8 digits are used at maximum of which 7 digits can be assigned for decimal values. The decimal point setting is determined by selecting the unit. Therefore, possible totaliser offsets are:

Unit *1

Unit *1/10

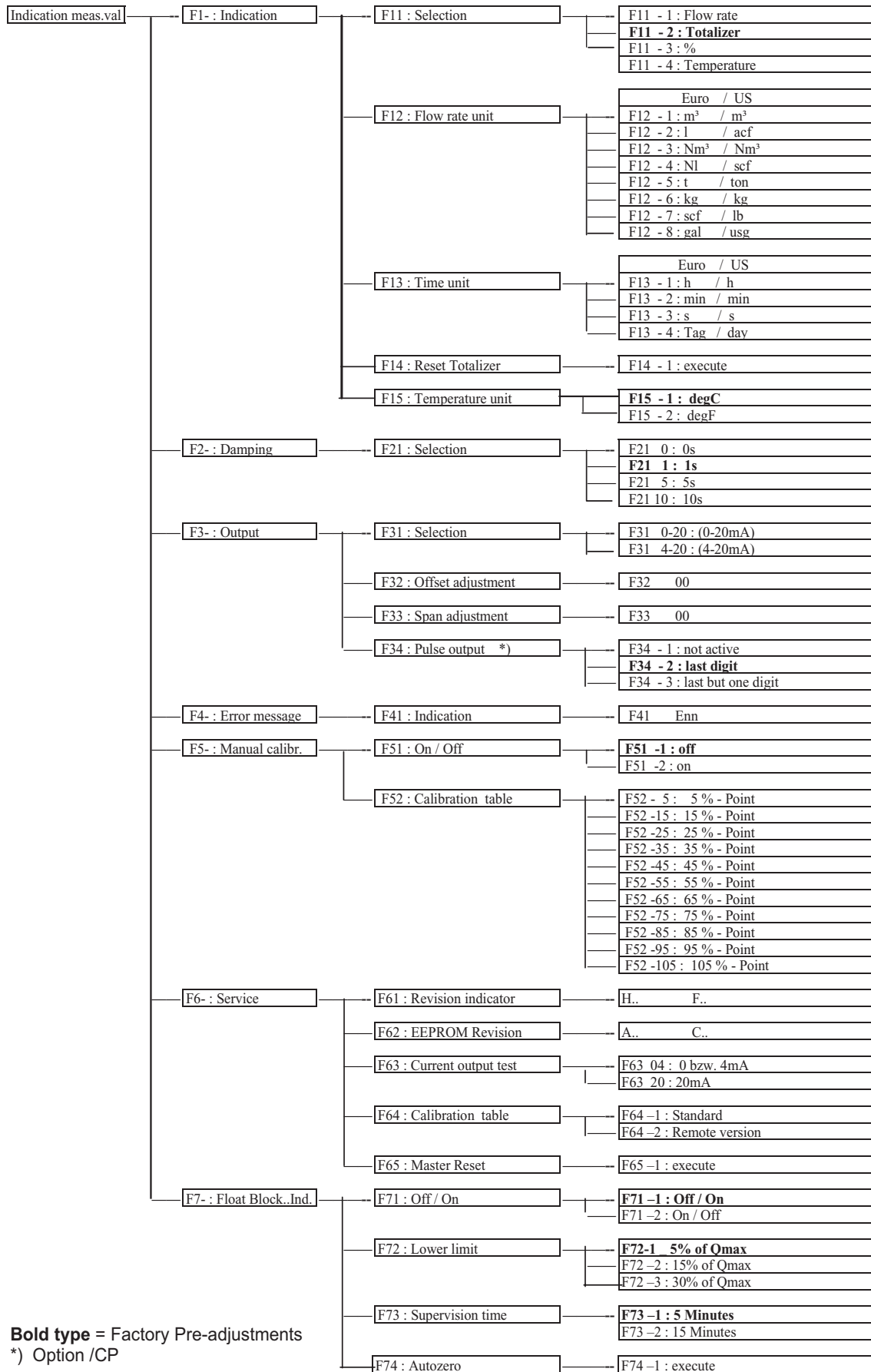
Unit *1/100

The totaliser counts up to 99999999 or 9999999.9 or 999999.99 and is reset to zero.

The next page shows the operating menu.

The following describes selection and execution of functions.

6. ELECTRONIC TRANSMITTER (-E)



Bold type = Factory Pre-adjustments

*) Option /CP

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6.2.1 Selection of indication function (F11)

The function F11 selects the display's indication function.

The following indications can be set: flow rate, totaliser, % value or temperature.

At the factory the display is preset to totaliser indication.

Description	Selection	Key	Indication
Change to setting mode		Enter	Display mode F1-
Setting function		Enter	F11
Selection	Flow rate	Enter	F11 -1
or	Totalizer	Enter	F11
		→	F11 -2
or	%	Enter	F11
		2 x →	F11 -3
or	Temperature	Enter	F11
		3 x →	F11 -4
		Enter	F11
Back to display mode		↑	F1-
		↑	Display mode

Note: If you press “↑” instead of “Enter”, you can return from the selected point to the previous menu without activating the displayed parameter.

When selecting “Flow rate” the measuring unit is set with function F12 and F13. When selecting “Totaliser” the measuring unit is set with F12. If % indication is selected, F12 and F13 have no effect. The internal totaliser is updated, if “Flow rate” or “Counter” is selected. In case of setting to “%” the internal counter is not updated and keeps its previous value.

If "Temperature" is selected the unit can be set by function F15. The indicated value is the temperature in the indication unit.

After changing the indicating function and measuring units the corresponding measuring unit label should be fixed on the right side next to the display.

6.2.2 Setting the unit (F12 / F13)

When ordering the transmitter two sets of metering units are available. It is not possible to switch between them. These two sets comprise the following metering units:

European unit set, Standard

	Standard	Description	Unit	Menue / Index
Flow rate unit	SI	Cubic meter	m ³	-1
	SI	Liter	l	-2
	SI	Norm cubic meter (0°C; 1Atm.abs = 1.013bar)	Nm ³	-3
	SI	Norm Liter	Nl	-4
	SI	Ton	t	-5
	SI	Kilogram	kg	-6
	---	Standard cubic feet (21°C; 1Atm.abs=1.013bar)	scf	-7
	---	Gallon (imperial,UK)	gal	-8
Time unit	SI	Hour	h	-1
	SI	Minute	min	-2
	SI	Second	s	-3
	---	Day	d	-4

US unit set, Option /A12

	Standard	Description	Unit	Menue / Index
Flow rate unit	SI	Cubic meter	m ³	-1
	---	Actual cubic feet	acf	-2
	SI	Norm cubic meter (32°F; 1Atm-abs=14.69psi)	Nm ³	-3
	---	Standard cubic feet (70°F; 1Atm.abs=14.69psi)	scf	-4
	---	Long ton	ton	-5
	SI	Kilogram	kg	-6
	---	Pound	lb	-7
	---	Gallon (US)	usg	-8
Time unit	SI	Hour	h	-1
	SI	Minute	min	-2
	SI	Second	s	-3
	---	Day	D	-4

6. ELECTRONIC TRANSMITTER (-E)

With functions F12 and F13, the measuring unit for displayed value is selected.

F12 selects volume and mass units, while F13 sets the corresponding time unit.

When selecting the indication function "totalizer" the set time unit is not taken into account and only the selected mass or volume unit is effective. When choosing the "%" indication F12 and F13 have no effect.

The selection of the measuring unit is performed as follows:

Description	Selection	Key	Display
Change to setting mode		Enter	Display mode F1-
Setting mode		Enter	F11
Masse/Volume unit	unit set	→	F12
	Euro US	Enter	F12 -1
Selection unit	m3 m3	Enter	F12
or	l acf	→	F12 -2
or	Nm3 Nm3	Enter	F12
or	Nl scf	2 x →	F12 -3
or	t ton	Enter	F12
or	kg kg	3 x →	F12 -4
or	scf lb	Enter	F12
or	gal usg	4 x →	F12 -5
		Enter	F12
		5 x →	F12 -6
		Enter	F12
		6 x →	F12 -7
		Enter	F12
		7 x →	F12 -8
		Enter	F12
Setting		→	F13
Time unit		Enter	F13 -1
Selection time unit	h h	Enter	F13
or	min. min	→	F13 -2
or	s s	Enter	F13
or	day day	2 x →F	13 -3
		Enter	F13
		3 x →	F13 -4
		Enter	F13
Back to display mode		↑	F1-
		↑	Display mode

Note: If you press "↑" instead of "Enter", you can return from the selected point to the previous menu without activating the displayed parameter.

After changing the measuring unit the corresponding measuring unit label should be fixed on the right side next to the display. A sheet with stickers is included.

Attention: When switching the mass/volume unit the totalizer is reset to zero.
When changing the time unit the totalizer value remains unchanged.

6.2.3 Totalizer reset (F14)

Function F14 resets the totaliser to zero.

The counter reset is performed as follows:

Description	Selection	Key	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode		Enter 3x → Enter	F11 F14 F14-1
Selection	Reset	Enter	F14
Back to display mode		↑ ↑	F1- Display mode

Note: If you press “↑” instead of “Enter”, you can return from the selected point to the previous menu without activating the displayed parameter.

6.2.4 Selection of temperature unit (F15)

The function F15 sets the unit of temperature indication.

The following indications can be set : degC (Celsius) or degF (Fahrenheit).

At the factory the display is set to degC indication.

The selection of the indication is as follows :

Description	Selection	Key	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode		Enter 4x → Enter	F11 F15 F15-1
Selection or	degC degF	Enter → Enter	F15 F15-2 F15
Back to display mode		↑	F1- Display mode

Note: If you press “↑” instead of “Enter”, you can return from the selected point to the previous menu without activating the displayed parameter.

6.2.5 Setting of damping (F2-)

Function F21 allows damping the output with a certain time constant (63% value). Normally the time constant is set to 1 sec.

The selection of the time constant is as follows:

Description	Selection	Key	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode		→ Enter	F2- F21
Selection damping constant or or or	0s	Enter	F21 0
	1s	Enter	F21 1
	5s	→ Enter	F21 5
	10s	2 x → Enter	F21 10
		3 x → Enter	F21
		↑ ↑	F1- Display mode

Note: If you press “↑” instead of “Enter”, you can return from the selected point to the previous menu without activating the displayed parameter.

6.2.6 Selection / Adjustment 4-20 mA / 0-20 mA (F3-)

Function F3- sets the current output to 4-20mA or 0-20 mA. In addition, offset and span have to be readjusted. Offset compensation is for fine tuning the 0 or 4mA point. Span or range compensation is for precise adjustment of the 20mA point.

For compensating the output, an ampere metre (mA) should be connected to the circuit loop. For wiring refer to the diagrams in chapter 3.

The current output is set according to customer specifications at the factory.

Switching the output is executed as follows:

Description	Selection	Key	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode Output selection		2x → Enter Enter	F3- F31 F31 0-20
Selection or	0-20 mA 4-20 mA	Enter → Enter	F31 F31 4-20 F31
Setting function Offset-Adjustment		→ Enter	F32 F32 00
Offset-Adjustment (Setting current to 0/4mA)	Increase Decrease if 0/4 mA	↑ → Enter	F32 in steps of +1 (+20 µA) F32 in steps of -1 (-20 µA) F32
Setting function Span setting		Enter	F33 F33 00
Span setting (Justierung des 20 mA-Punkts)	Increase Decrease if 20 mA	↑ → Enter	F33 in steps of +1 (+20 µA) F33 in steps of -1 (-20 µA) F33
Back to display mode		↑ ↑	F3- Display mode

An adjusting step corresponds to 20 μ A. The complete adjusting range is ± 0.62 mA (31 steps). If the adjusting range does not suffice, change to display F32 or F33 by pressing ENTER when display shows F32 31 or F33 31, press ENTER again and continue adjusting at F32 00 or F33 00.

3 wire connection:

At this the ranges 0-20 mA and 4-20 mA are possible. At a switchover between the two ranges with F31 the current output is automatically adjusted at equipments as of firmware version 1.4 . (s.F61). A perhaps necessary fine adjustment can be carried out with F32 or F33.

2 wire connection:

At this only the range of 4-20 mA is meaningful. The range of 0-20 mA is not closed however. At the change to 0-20 mA with F31 the equipment assumes a remodelling on 3 wire connection and the current output is adjusted according to this. A perhaps necessary fine adjustment can be carried out with F32 or F33.



WARNING

Since YOKOGAWA doesn't have any influence on the custom-designed connection the current output is not automatically adapted, if the connection is changed from 2 wire to 3 wire or vice versa .This must be manually carried out with the functions F32 and F33.

Preset values :

Current range | Connection	2-wire	3-wire
0-20mA	-----	lo = 0mA l ₂₀ = 20mA
4-20mA	l ₄ = 0,4mA + 3,6mA l ₂₀ = 16,4mA + 3,6mA	lo = 4mA l ₂₀ = 20mA
Note	Do not use F31	Use F31 for changing

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6.2.7 Pulse output (F34) (Option /CP)

With the function F34 the optional pulse output can be activated and adjusted.

Description	Selection	Key	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode		2 x → Enter 3 x →	F3- F31 F34
Selection or or	Activation Resolution last digit Resolution last but one digit	Enter Enter → Enter → Enter	F34 -1 F34 F34 -2 F34 F34 -3 F34
Back to display mode		↑ ↑	F5- Display mode

6. ELECTRONIC TRANSMITTER (-E)

6.2.7.1 General

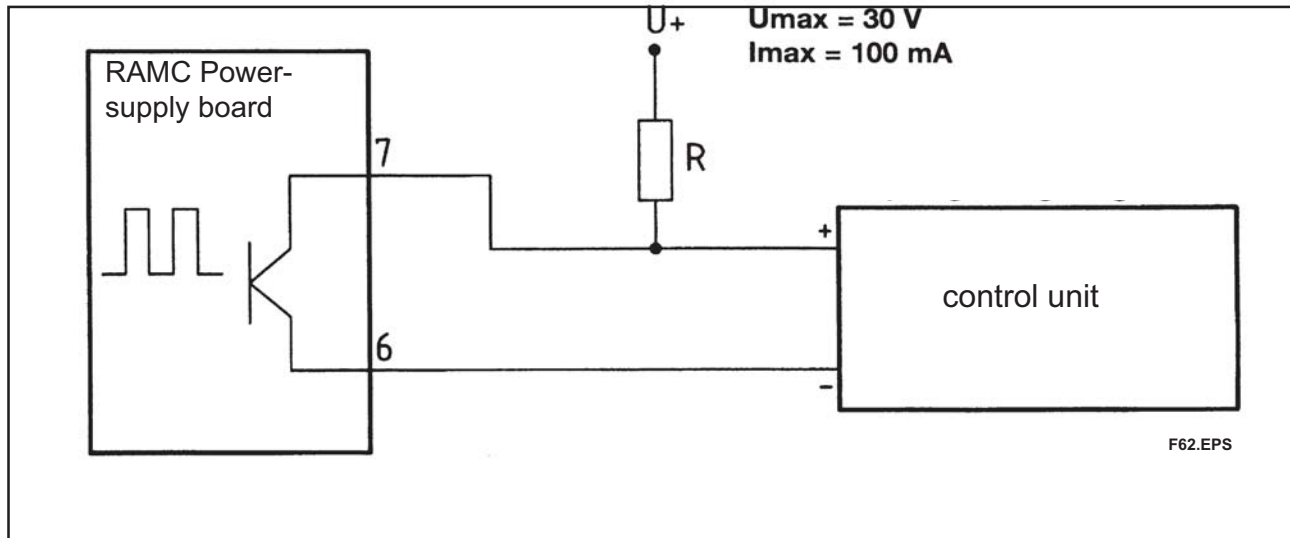
The volume totalizer function in the angle-transmitter WT-MAG is available with a potentialfree pulse contact.

The connection is supported only at 4-wire-units on the power supply at pins 6, 7.

The pulse output is activated and selected by function F34 in the menu structure.

Two different pulse rates can be selected. The lower pulse rate (higher resolution) corresponds to the last (least significant) digit of the totalizer. The higher pulse rate (lower resolution) corresponds to the last but one digit of the totalizer.

6.2.7.2 Connection



6.2.7.3 Adjustments

The function F34 is added to the menu structure.

With the selection of F34 -1 the pulse output is switched off. With the selection of the functions F34 -2 or F34 -3 the pulse output is activated with the concerning resolution.

- F34 -1 not active
- F34 -2 last totalizer digit
- F34 -3 last but one totalizer digit

Special case : If Q_{max} is higher than 10000, the pulse rate is increased by factor 10 in both cases. That means:

- F34 -2 last but one totalizer digit
- F34 -3 third totalizer digit from the right

6.2.7.4 Calculation of pulse rate

Concerning the final flow-value (Q_{\max}), which was declared in the customers order, the pulse rate is calculated in factory and is written onto the sheet 'Data of Pulse Output (Option /CP)', which is included. This value can be transferred to a blank label of the also included sheet with unit-stickers and then fixed on the scale. After changing the flow rate unit with F12 the pulse rate must be recalculated.

Calculation of pulse rate :

- Read the value of Q_{\max} from the scale or recalculate it.
- Search for the concerning range in the first row of the table below.
- Read the concerning pulse rates in the second and third row.
- The measuring unit is equal to the flow

Maximum flow Q_{\max} without unit	Pulse rate for F34-2 without unit	Pulse rate for F34-3 without unit
$Q_{\max} \leq 1$	0.0001	0.001
$1 < Q_{\max} \leq 10$	0.001	0.01
$10 < Q_{\max} \leq 100$	0.01	0.1
$100 < Q_{\max} \leq 1000$	0.1	1
$1000 < Q_{\max} \leq 10000$	1	10
$10000 < Q_{\max} \leq 100000$	10	100

e.g.: Final value (Q_{\max}) = 400 m³/h

→ Pulse rate 0.1m³ for F34-2 and 1m³ for F34-3



NOTE

- The factory default is F34 -2 (solution : 1 last digit).
- After Master Reset F34 -1 (Pulse output not activ) is selected.
- After changing the flow rate unit with F12 the pulse-register is deleted and the pulse rate is automatically redefined according to the new unit.
- After totalizer Reset with F14 the pulse output does not change.
- When changing the indication with F11 -3 to '%', the totalizer stops and the pulse output is switched off.
- After switching power on one pulse is generated at the output.
- For 2- respectively 3-Wire-Units the function F34 is not supported.

6.2.8 Error messages (F4-)

If the 8 bars beneath the digits start flashing, an error has occurred in the measuring transmitter/current output. Since the pointer indication is independent from the electric measuring transmitter, it may show the correct measuring value even if the transmitter is defective. Function F41 allows checking of assigned error codes.

Error codes are called onto the display as follows:

Description	Selection	Key	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode		3x → Enter Enter Enter	F4- F41 F41 Enn F41
Back to display mode		↑ ↑	F1- Display mode

List of error messages :

Code	Meaning	Remedy
01	RAM-error	Indication unit needs service
02	ADC-error	Indication unit needs service
03	Internal EEPROM faulty	Indication unit needs service
04	Calibration-EEPROM faulty	If EEPROM is missing insert,-otherwise order new EEPROM
05	Wrong totalizer value in EEPROM	Reset totalizer
06	Overflow (flow rate too high)	Reduce flow rate
07	Internal EEPROM faulty	Indication unit needs service
08	Float blocking indication realized, supervision time gone off	Deactivate float-blocking-indication or run Autozero function

In case of error the appropriate remedy has to be taken.

6.2.9 Manual calibration (F5-)

The relation of mm-to-flow rate is determined by the calibration process and reflected by the scale. The user can change this allocation by manual calibration. The unit can be reset anytime to the original calibration. Manual calibration can be performed when changing, for example, the measured fluid (density, temperature, viscosity) for the same measuring tube.

In this case a new scale has to be established often, since the flow conditions have changed. Upon demand a calibration table for a given state of operation/aggregation is made available for each measuring tube. If you want to measure with the measuring tube in a different range, you either have to calculate the corresponding flow rate range on basis of the data in the calibration table (refer to instructions about RAMC scale conversion) or order a new scale.

A new mm-to-flow rate assignment is the result.

With the manual calibration function the current output is manually adjusted to a new scale. It is recommended instead of using this function to buy a new scale and EEPROM.

After activating the manual calibration function, the digital display only shows % (percentage).

For the following preset flow rate values the new mm values must be calculated:

5%, 15%, 25%, 35%, 45%, 55%, 65%, 75%, 85%, 95%, 105% (11 values)

Execution:

Manual calibration is switched ON/OFF by the following functions:

F51-1 ENTER → Switched OFF

F51-2 ENTER → Switched ON

At the time of shipping, the manual calibration table is identical with the measuring tube calibration table.

The manual calibration table can be overwritten anytime by executing the following function:

F52-5 ENTER 1st point

F52-15 ENTER 2nd point

F52-105 ENTER 11th point

Place the RAMC (with measuring tube) horizontally on a table (the distance to ferro-magnetic parts must be at least 25 cm). By shifting the float, the pointer is set to the calculated mm values, starting from the 5% flow value (refer to display). After a short settling period (approx. 4 seconds) the mm value corresponding to this flow rate can be input by pressing both buttons (ENTER). After inputting all 11 values the manual calibration table is memorized and can be activated. The inputting operation can be stopped by pressing button ↑.

Previous values, input by pressing ENTER, are retained in the memory.

Interaction with other functions:

	Action	Function	Effect
1.	Setting of manual calibration values	F52 -5...	Manual calibration table is overwritten
2.	Activating of manual calibration table	F51 -2	<ul style="list-style-type: none"> - Manual calibration table active - %-indication only - Totalizer does not count - No other flow rate unit selectable - Function F64 for option /A2 has no effect, with manual calibration
3.	Deactivating of manual calibration table	F51 -1	<ul style="list-style-type: none"> - Standard calibration table active - F11 is set to flow rate - Flow unit is the same as before activating manual calibration - Totalizer value is the same as before activating manual calibration

**NOTE**

When manually calibrating is active, the user is responsible for the measurement accuracy.

Activating/deactivating manual calibration table (F51)

Description	Selection	Key	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode		4 x →	F5-
Selection	Change state Take state	Enter Enter → Enter	F51 F51 -1 or -2 (*) F51 -2 or -1 F51
Back to display mode		↑ ↑	F5- Display mode

(*) -1 : manual calibration OFF; -2 : manual calibration ON

Input of manual calibration table (F52)

The manual calibration table is input as follows:

Description	Selection	Key	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode		4 x → Enter →	F5- F51 F52
Setting points	5%- point 15%- point 25%- point 35%- point 45%- point 55%- point 65%- point 75%- point 85%- point 95%- point 105%- point	Enter Enter Enter Enter Enter Enter Enter Enter Enter Enter Enter	F52 F52 - 5 F52 -15 F52 -25 F52 -35 F52 -45 F52 -55 F52 -65 F52 -75 F52 -85 F52 -95 F52 -105
Back to display mode		↑ ↑	F5- Display mode

6.2.10 Revision indication (F61/F62)

Functions F61 and F62 enable the indication of revision states for hardware, software of calibration EEPROM and internal EEPROM.

The indication is called up as follows:

Description	Selection	Key	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode Revision		5 x → Enter Enter	F6- F61 Hhh ¹ Fff ²
Setting mode EEPROM-Revision		↑ → Enter	F61 F62 Aaa ³ Ccc ⁴
Back to display mode		↑ ↑	F6- Display mode

¹ H = Hardware ² F = Firmware ³ A = Internal EEPROM ⁴ C = Calibration-EEPROM

6.2.11 Current output test (F63)

Function F63 sets the output current to 0/4mA or 20mA respectively.

With this you can determine whether output current correction by function F32 is required.

The adjustment of the current output is as follows:

Description	Selection	Key	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode		5 x → Enter 2x →	F6- F61 F63
Selection or	Output 0/4mA Output 20mA	Enter → Enter	F63 0/4 F63 20 F63
Back to display mode		↑ ↑	F6- Display mode

Note: During selection you can switch between 0/4mA and 20mA with the "→"-key.
If you press "↑" instead of "Enter", you can return from the selected point to the previous menu item without activating the displayed parameter.

6.2.12 Switching between standard / remote version (F64)

F64 allows switching between the standard calibration table and a calibration table of the remote version (option /A2 for high temperatures). The adjustment has to be performed according to the RAMC type (MS code).

This is done as follows:

Description	Selection	Key	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode		5 x → Enter 3x →	F6- F61 F64
Selection or	Standard Remote version	Enter → Enter	F64 -1 F64 -2 F64
Back to display mode		↑ ↑	F6- Display mode

Note: If you press “↑” instead of “Enter”, you can return from the selected point to the previous menu without activating the displayed parameter.

6.2.13 Master Reset (F65)

If the unit shows aberrant behaviour or does not execute functions any longer, function F65 allows a master reset of the micro controller.

Attention: All parameter settings are reset to factory settings (see operation menu).

The master reset is executed as follows:

Description	Selection	Key	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode		5 x → Enter 4x →	F6- F61 F65
Selection	Reset	Enter Enter	F65 -1 F65
Back to display mode		↑ ↑	F6- Display mode

Note: If you press “↑” instead of “Enter”, you can return from the selected point to the previous menu without activating the displayed parameter.

6.2.14 Float blocking indication (F7-)

6.2.14.1 Function

Float

Pulsating movements of the flow medium (gasses, liquids) lead to fluctuations of the float and with that to fluctuations of the tap system/pointer. Therefore the electrical measuring signal permanently changes and with that the display value and the output current value.

The fluctuations can be reduced with the help of the damping function "F21". That shows however that the medium still flows and the float/the tap system is not blocked. This means that in most applications there is a permanently changing measuring signal which can be used for the recognition of the movement or the blockade of the float.

Basic noise

Since it is an electronic evaluation circuit, permanently minimal fluctuations of the measuring signal appear. The basic noise is caused by vibrations in the plant as well as by temperature influences or external magnetic fields. The basic noise also appears, if

- no medium flows through the measuring pipe
- the float and with that the tap system are in the rest position
- the float/the tap system is blocked.

Float-Blocking-Indication

The function of the Float-Blocking-Indication allows the WT-MAG to distinguish the fluctuations, which are caused by a moving float, with the fluctuations of the basic noise to state a fault status. If the measuring signal does not exceed the autozero value during a defined supervision time, this is recognized as blockade and an error condition is shown.

6.2.14.2 Operation

Switching on

At delivery of the equipment the Float-Blocking-Indication is turned off. By the function "F71 2" the Float-Blocking-Indication can be activated.

Autozero function

The autozero function is called to find out the level of basic noise in the application. This is started with the function "F74 1" and lasts for 90 seconds. While the autozero function is running the value "0.000" is displayed and the 4 bars will flash below the numbers. After approx. 80 seconds the current autozero value appears on the display. This value gets stored and will not be lost after power off / on the RAMC or after switching off / on the Float-Move-Detection-function. The stored value is typed over first after a renewed autozero.

Autozero without flow

To execute the autozero function the following expiry is recommended:

- Plant in operation (measuring tube filled with medium)
- Drive flow to zero (place float into rest position)
- Raise the pointer to 10% to 20% of the flow and fix it on the scale with adhesive tapes or underlaid paper stripe .
- Start Autozero function by menu.
- Check Autozero value after approx. 80 seconds.

During the Autozero function it absolutely has to be respected that:

- the RAMC is not moved by touching or using the 2 buttons.
- the pointer is protected against slipping.
- the tube is not exposed to strong tremors

If these prerequisites are not adhered, it comes to the inquiry of too high autozero results. This leads that a relatively quiet flow can trigger the Float-Blocking-Indication

6. ELECTRONIC TRANSMITTER (-E)

Autozero with flow

The Autozero function can be carried out also under flow, if the flow cannot be switched off. To this the following expiry is recommended:

- Plant in operation (measuring tube filled with medium)
- Move flow to constant value (preferably between 10% and 40%)
- Fix pointer on the oriented scale factor with adhesive tapes or underlaid paper stripe
- Start Autozero function by menu.
- Check Autozero value after approx. 80 seconds.

It has to be respected on this absolutely, for this the flow is constant during the Autozero duration!
Normally at this variant higher Autozero results must be expected !

Autozero range

The factory default autozero value is zero (0.000).

At the inquiry of the autozero value it has to be respected that the pointer / tap system are not in the rest position. In this case the autozero value is zero and the Float-Move-Detection does not work.

Normally the autozero value is smaller than 0.200. If higher results should appear in the application, a multiple inquiry of the autozero value is recommended to confirm the value.

Supervision range (measuring range)

The measuring range in which Float-Move-Detection is active lies between 5% and 105% of the maximum flow Q_{max} (Factory Setting). With the help of the function "F72" this range can be reduced if a supervision is not possible or not desired in the lower flow range. The range can be restricted to 15% or 30% to 105% (see point 3.1 to 3.3).

Supervision time (Time Out)

The supervision time of the measuring signal is 5 minutes (Factory Setting). If the measuring signal should not exceed the autozero value during this period, this is recognized as blockade and an error condition is shown. The supervision time can be increased with the function "F73" up to 15 minutes.

Indication of a blocking condition

After the recognition of the blockade the error code "08" is produced and the bars under the displayed measurement value are flashing (see fault behavior). Simultaneously the current output is set to a value, which enables a clear fault detection of a connected evaluation unit :

- 2 - wire 4-20 mA: Error condition: IA (IG) < 3,6 mA
- 3 - wire 4-20 mA: Error condition: IA < 0,0 mA
- 3 - wire 0-20 mA: Error condition: IA = 0,0 mA

6.2.14.3 Unsuitable applications

It is possible, that the Float-Blocking-Indication- Function does not work satisfactorily. This can be caused with different factors which are explained briefly here. In these cases the function of the Float-Blocking-Indication is not suitable for the respective application and it should be turned off.

Applications with gasses

At applications with gasses and float-damping it can happen, that the pulsating movements of the medium (and with that of the float) are damped so strongly in the measuring tube, that the measuring signal lies under the autozero value and a Float-Blocking-Indication is not possible.

Applications with high viscous media

If a high viscous medium should be used in the plant, the damping can get so high by the high viscosity of the flow that the measuring signal lies below the autozero value, and a Float-Blocking-Indication is not possible.

Applications with quiet flow

If the plant has an extremely quiet flow (gasses or liquids) ,the supervision range can be limited in the lower flow range. Normally greater flow (>30%) causes greater medium flow deviations. The duration of the supervision can be put to 15 minutes to reach a longer supervision time.

6.2.13.4 Parameter setting

Error message (F41)

Code	Meaning	Remedy
08	Float blockage Supervision time gone off	Check float in tube, clean tube if necessary Deactivate float blocking indication or run Autozero function.

Factory defaults / Master Reset (F65)

The RAMC is adjusted at delivery (Factory Setting):

- F71 - 1 **Float-Move-Detection OFF**
- F72 - 1 **Lower limit value of the supervision area 5 %**
- F73 - 1 **Supervision time (Time Out) 5 min**
- F74 **Autozero inactive Autozero value = 0**

After Master Reset the following attitudes are given :

- F71 - 1 **Float-Blocking-Indication OFF**
- F72 - 1 **Lower limit value of the supervision area 5 %**
- F73 - 1 **Supervision time (Time Out) 5 min**
- F74 **Autozero inactive Autozero value not changed**

Damping (F21)

The selection of the damping value has no influence on the autozero value or the measurement value of the Float-Blocking-Indication !

6. ELECTRONIC TRANSMITTER (-E)

Float-Blocking-Indication (F7x)

Function F71: On-/Off- switching of the float-blocking-indication

Description	Selection	Key	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode		6 x → Enter	F7- F71
Selection	FBI OFF/ON FBI ON/OFF	Enter → Enter	F71 -1 or -2 F71 -2 or -1 F71
Back to display mode		↑ ↑	F7- Display mode

Function F72: Selection of the lower limit value of the supervision range

Description	Selection	Key	Indication
Change to setting mode		Enter	Display mode F1-
setting mode		6 x → Enter →	F7- F71 F72
Selection	5% of Qmax	Enter	F72 -5
or	15% of Qmax	Enter →	F72 F72 -15
or	30% of Qmax	Enter → Enter	F72 F72 -30 F72
Back to display mode		↑ ↑	F7- Display mode

Function F73: Selection of the supervision time

Description	Selection	Key	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode		6 x → Enter 2x →	F7- F71 F73
Selection	5 minutes	Enter	F73 -5
or	15 minutes	Enter → Enter	F73 F73 -15 F73
Back to display mode		↑ ↑	F7- Display mode

Function F74: Start Autozero function and storage

Description	Selection	Key	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode		6 x → Enter 3x →	F7- F71 F74
Selection	Autozero	Enter	F74 -1
Inquire autozero value (80s)		Enter	0.000
Display autozero value (10s)			0.xxx
Back to display mode		↑ ↑	F7- Display mode

7. HART® - Communication

7.1 General

RAMC with indication unit type -H have, additional to the current output, the possibility for HART®-Communication. Also without HART®-Communication the units are fully able to work. The HART®-Communication does not influence the current output, except in Multidrop-Mode (see below).

There exists no difference between the not-Ex and the Ex versions. For use in the hazardous area a HART®-able transmitter power supply is required.

Single-Mode :

The poll adresse must be zero in Single-Mode.

Multidrop-Betrieb :

In Multidrop-Mode maximum 15 HART®- units can be connected parallel. Therefore the poll-adresse must be differnt from zero. The current output is switched to 4mA and there are all functions of the unit available.



NOTE

The HART®-Communication is only available with plugged calibration-EEPROM



NOTE

The HART®-Communication is only available for 2-wire units, 4 ... 20mA. Therefore the short-circuit bridge must be connected between ' A ' and '-'.

Deviations in the RAMC-Menu

In HART® devices the operating menu according chapter 6 is not available.

Pressing the ↑ -button the indication can be changed between flow, totalizer and temperature.
Factory default is totalizer.

Pressing → button an error indication appears on display.
00000000 or 00000000

A detailed explanation see chapter 7.4.2

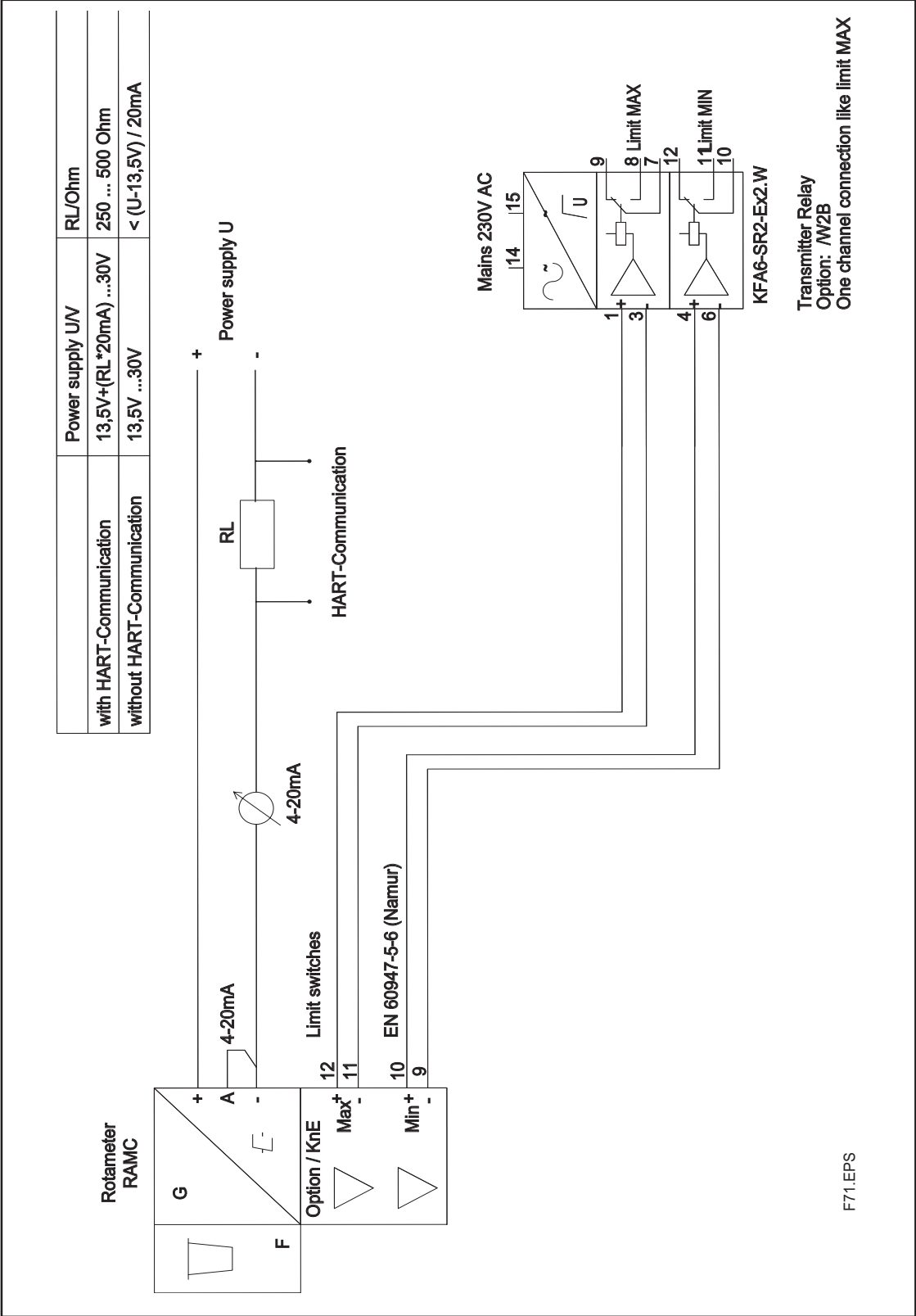
7.2 Connection

The connection is carried out in accordance with below figure. Please note, that the load resistor must have a value between 250 and 500Ω .

The minimum power supply is 13.5V + (RL*20mA) ; RL = load resistor

The maximum power supply is 30V.

As connection cable a protected twisted cable pair is recommended.



7.3 HART Menue RAMC (Rev 01 DD rev 02)

HOT KEY	Write protect Enable wrt 10 min New password		R W W
----------------	---	--	-------------

Available in generic mode

R=Read,
W=Write,S=Set

T=Test, p=perform

Device Setup	Process Variables	Flow value [cum/h]					R
		Flow % mge [%]					R
		Flow AO value [mA]					R
		Totalizer value [kg]					R
		% Span value					R
		Temperature value [°C]					R
Flow Flow AO	Diag/ Service	Test device	Device status	Status group 1	RAM error ADC error ADJ.EE error CAL.EE error Totalizer false Flow overrun ADJ error 2 Float blocked		R R R R R R R R
Flow LRV Flow URV				Status group 2	Temp over limit | Max flow 1 active Max flow 2 active FB autoz active | Power fail warn Oper timer error Mancal active |		R R R R R R R R
			Reset all errors	reset			p
			Self test	perform			p
			Master reset	perform			p
		Loop test	4mA/20mA/other/end				T
		Calibration	Apply URV/LRV	4 mA	Set as 4mA value Read new value Leave as found		S S S
				20 mA	Set as 20mA value Read new value Leave as found		S S S
				Exit			
			Reset URV/LRV	Reset 4 mA Reset 20 mA Exit	Perform Perform		p p
			D/A trim	4 mA/ 20mA			S
			calib table	Std version Dist version			R/S R/S
			Manual calib	Status mancal	ON / OFF		R
				Activate/deactiv	ON / OFF		S
				Set mancal points	5%/15%/ ... /95%/105%		S

7. HART-COMMUNICATION

			Diagnostics	Temp max log	Temp max log	ON / OFF	p
					Duration/value	Days Hours Minutes Temp max	R R R R
					Old durat/value	Days Hours Minutes Temp max	R R R R
					Clear values	clear	p
				Flow URV log	Flow URV log	ON / OFF	p
					URV overrun time	Days Hours Minutes	R R R
					URV underrun time	Days Hours Minutes	R R R
					Min overrun time	15 sec 30 sec 1 min 5 min 10 min	R/S R/S R/S R/S R/S
					Clear values	clear	p
				Float blocking	Float blocking	ON / OFF	p
					Set lower limit	5% 15% 30%	R/S R/S R/S
					Set supervis time	Turbulent flow Smooth flow	R/S R/S
					Start autozero	Start	p
					Autozero value		R
			Power monitoring	Operation time	Days; Hours; Minutes		R
				Oper time shadow	Days; Hours; Minutes		R
				Reset power fail	Reset		p
				Basic Setup	Tag		R/W
					Flow unit [unit]		R/W
					Temp unit [unit]		R/W
					Set damping		R/W
					Long tag		R/W
				Detailed Setup	Characterize meter		
					Snsr unit		R
					Scale USL		R
					Snsr s/n		R
					Final assy no		R
					MS-Code		R
				Configure signal	Flow damping	Flow damp	R
					Set damping	0.25 sec 1.00 sec 5.00 sec 10.00 sec	R/S R/S R/S R/S

				Flow unit table	EU /US	EU	US	R
				Flow units select	Cum / h	*	*	R/S
					L / h	*		R/S
					NmlCum / h	*	*	R/S
					NmL / h	*		R/S
					MetTon / h	*		R/S
					Kg / h	*	*	R/S
					StdCuFt / h	*	*	R/S
					Imp Gal / h	*		R/S
					Cum / min	*	*	R/S
					L / min	*		R/S
					NmlCum / min	*	*	R/S
					NmL / min	*		R/S
					MetTon / min	*		R/S
					Kg / min	*	*	R/S
					StdCuft / min	*	*	R/S
					Imp gal / min	*		R/S
					Cum / h	*	*	R/S
					NmlCum / h	*	*	R/S
					Kg / h	*	*	R/S
					StdCuFt / h	*	*	R/S
					CuFt / h		*	R/S
					LTon / h		*	R/S
					Lb / h		*	R/S
					gal / h		*	R/S
					Cum / min	*	*	R/S
					NmlCum / min	*	*	R/S
					Kg / min	*	*	R/S
					StdCuFt / min	*	*	R/S
					CuFt / min		*	R/S
					LTon / min		*	R/S
					Lb / min		*	R/S
					gal / min		*	R/S
				Total reset	perform			p
				Temperature unit	degC			R/S
					degF			R/S
			Configure output	Analog output	Flow AO			R
					AO alarm typ			R
					Loop test			T
					D/A trim			T
				HART output	Poll addr			R/W
					Num req preams			R
					Num resp preams			W
			Display selection	Standard	ManCal			
				Flow	Percent			R/S
				Totalizer	Temperature			R/S
				Temperature				R/S
			Device information	Model				R
				Dev Id				R
				Manufacturer				R
				Distributor				R
				Snsr s/n				R
				Final assy no				R
				Write protect				R
				Tag				R/W
				Descriptor				R/W
				Message				R/W
				Date				R/W
				Poll addr				R/W
				Num req preams				R
				Num resp preams				W
				Long tag				R/W
				MS Code				R

7. HART-COMMUNICATION

			Revisions #'s	Universal rev. Fld Dev. rev. HW rev.: FW rev.: ADJ-EE rev.: CAL-EE rev.:	R R R R R R
	Review	Model Dev Id Manufacturer Distributor Flow Snr s/n Final assy no Write protect Tag Descriptor Message Date Poll addr Num req preams Num resp preams Long tag MS Code Universal rev. Fld. Dev. rev. HW rev.: FW rev.: ADJ-EE rev.: CAL-EE rev.:			R R R R R R R/W R/W R/W R/W R W R/W R R R R R

The generic menu structure differs to the implemented menu structure. The generic mode does not support all implemented commands. The parameters with grey background are also contained in generic mode.

7.4. Description of the HART®- Parameter

HOT KEY	Write protect Enable wrt 10min New password	Read Status of write protection Enable writing for 10 minutes by entering password. After writing a parameter the time of 10 minutes starts again. Selection of a new password by entering up to 8 character If 8 blanks are entered as new password, write protection is disabled. If the user password is lost, a joker password is available from the YOKOGAWA service department.
Online	This shows current process data. Flow Flow AO Flow URV Flow LRV	Flow in selected measurement unit Current output in mA Upper range value related to the current output Lower range value related to the current output

7.4.1 Process variables

Device setup

Process variables

Flow value [cum/h]	Flow in oriented measurement unit
Flow % range [%]	%-value related to 20mA
Flow AO value [mA]	Current output in mA
Totalizer value [kg]	Totalizer
% span value	%-Value related to flow final value
Temperature value [°C]	Temperature in transmitter

7.4.2 Diagnostic- and Service-Menu

Device setup

Diag/Service

Test device

Device status

Status group 1

Error indication:

RAM Error	OFF/ON	Memory error
ADC Error	OFF/ON	error A/D converter
ADJ-EE-Error	OFF/ON	error adjustment-EEPROM
CAL-EE Error	OFF/ON	error calibration-EEPROM
Totalizer false	OFF/ON	totalizer value false
Flow Overrun	OFF/ON	Flow too high
ADJ Error 2	OFF/ON	adjustment-EEPROM fault
Float blocked	OFF/ON	Float-Move-Detection recognized, supervision time passed

Device setup

Diag/Service

Test device

Device Status

Status group 2

Error indication:

Temp over limit	OFF/ON	Temperature exceed 70°C
Max flow1 active	OFF/ON	URV overrun
Max flow2 active	OFF/ON	URV underrun
FB autoz active	OFF/ON	Float blocking autozero on
Power fail warn	OFF/ON	Power off has happened
Oper timer error	OFF/ON	Operation timer fault
Mancal active	OFF/ON	Manual calibration activated

7. HART-COMMUNICATION

Error description :

	Status	Type	Current value	Bars blinking	Error on Display	Self-Test	HHT275	Reset Function by	Clear all
Status group 1	RAM error	error	3,6 mA / >21 mA	-----	00000001	check	ON/OFF	NO (RAMC to service !)	no
	ADC error	error	3,6 mA / >21mA	-----	00000010	check	ON/OFF	NO (RAMC to service !)	no
	ADJ-EE error	error	3,6 mA / >21mA	-----	00000100	check	ON/OFF	NO (RAMC to service !)	no
	CAL-EE error	error	3,6 mA / >21mA	-----	00001000	check	ON/OFF	Insert new EEPROM	no
	Totalizer false	warn	no change	-----	00010000	check	ON/OFF	Reset Counter	yes
	Flow overrun	warn	no change	-----	00100000	no check	ON/OFF	NO (active during overflow)	yes
Status group 2	ADJ error 2	warn	no change	-----	01000000	no check	ON/OFF	NO (RAMC to service !)	yes
	FB time elapsed	error	3,6 mA / >21mA	-----	10000000	no check	ON/OFF	Switch OFF Float Blocking Function	yes
	Temp over limit	warn	no change	-----	00000001	no check	ON/OFF	Switch OFF Temp Log Funct./Clear Values	yes
	Max flow1 active	warn	no change	-----	00000010	no check	ON/OFF	Clear Values at Flow Log Function	yes
	Max flow2 active	warn	no change	-----	00000100	no check	ON/OFF	Clear Values at Flow Log Function	yes
	FB autoz active	warn	no change	-----	00001000	no check	ON/OFF	NO (active during autozero)	yes
	Power fail warning	warn	no change	1)	00010000	no check	ON/OFF	Clear Warning at Operation Monitor	yes
	Operate timer error	warn	no change	-----	00100000	no check	ON/OFF	NO (RAMC to service !)	yes
	Mancal active	warn	no change	2)	01000000	no check	ON/OFF	Switch OFF Manual Calibration	yes

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- Type: The information will be divided into errors and warnings.
 Current: An error will change the output current to the selected error current level.
 The level is selectable by „Alarm select” in HART (default: LOW)!
- Bars: All 8 bars are blinking in case of an error or warning.
 Self test: Only the checked errors will be treated by the self test function.
 HHT275: The marked errors/warnings are displayed on the HHT275.
 Reset: The indicated error/warning can be reset or disabled by the listed operation.
- 1): On every Power Up, this warning occurs; it is NOT SHOWN ON DISPLAY.
 2): If this function is active, the bars are NOT BLINKING ON DISPLAY.

Device setup**Diag/Service****Test device****Reset all errors**

Reset all errors and warnings

Device setup**Diag/Service****Test device****Self test**

Execute a self test to find existing errors.

Device setup**Diag/Service****Test device****Master reset**

Execute master reset. All parameters are set to default.

Device setup**Diag/Service****Loop Test**Set the analogue output fix to 4mA, 20mA or arbitrary current.
Finish with 'End'.**Device setup****Diag/Service****Calibration****Apply URV/LRV**

- | | |
|------|---|
| 4mA | Assignment of 4mA
Set as 4mA value: Current flow is set to 4mA.
Read new value: Read current flow for 4mA.
Leave as found: No change |
| 20mA | Assignment of 20mA
Set as 20mA value: Current flow is set to 20mA.
Read new value: Read current flow for 20mA.
Leave as found: No change |
| Exit | Leave parameter |

7. HART-COMMUNICATION

Device setup

Diag/Service

Calibration

Reset URV/LRV

Reset 4mA	Set 4mA to factory set LRV
Reset 20mA	Set 20mA to factory set URV
Exit	Leave parameter

Device setup

Diag/Service

Calibration

D/A Trim

Adjustment of current output to 4mA and 20mA.

Device setup

Diag/Service

Calibration

Calib table

Selection of calibration table: Standard / Distance version

Device setup

Diag/Service

Calibration

Manual calib

Status manual	ON/OFF	Show status of manual calibration table
Activate/deactivate	ON/OFF	Activate or deactivate manual calibration table
Set manual points	5%...105%	Set manual calibration points
See description of manual calibration in chapter 6.2.9		

Device setup

Diag/Service

Diagnostics

Temp max log

Temp max log	ON/OFF	Activate or deactivate Temp max Logging function
Duration/value	Days Hours Minutes Temp max	Time since appearance of maximum temperature Max.temperature value
Old durat/value	Days Hours Minutes Temp max	Time since appearance of... ... maximum temperature before... ... clear or reset Max.temperature value before clear or reset
Clear values	The values in parameter <i>Duration/value</i> are written to parameter <i>Old durat/value</i> . Parameter <i>Duration/value</i> is cleared and temp max is set to actual temperature.	

Description of temperature maximum logging function:

The temperature value is supervised constantly. As soon as the value exceeds the actual maximum value, the time measurement starts. The minutes are added up, the period can be requested by the user any time. The actual maximum value is overwritten by a higher value automatically, if it lasts more than 30 seconds; the time measurement starts once more. The determined values (max temperature/period) can be cleared by the user. They are written into the parameter *Old durat/value* after *Clear values* or after power off/on, the actual time value is deleted, the max temperature value is set on the actual temperature value. By switching *Temp max log* off the values are not cleared.

When exceeding the maximum temperature of 70°C the error message "Temp over limit" appears.

Device setup**Diag/Service****Diagnostics****Flow URV log**

Flow URV log	ON/OFF	Activate or deactivate Flow URV Logging function
URV overrun time	Days/Hours Minutes	Time since... ... exceeding URV
URV underrun time	Days/Hours Minutes	Time since... ... fall below URV
Min overrun time	Selection of hysteresis time	
Clear values	Clears the values in <i>URV overrun time</i> and <i>URV underrun time</i>	

Description of Flow URV logging function :

The flow value is supervised constantly. As soon as the value reaches the upper limit value (103%; 20.5mA) (event 1), the time is measured, during the flow value is over the limit value. If this error condition remains actively longer than the *hysteresis* value, the limiting value recognition is activated and the condition stored. As soon as the flow value falls below the limit value, the supervision (event 2) ends, for a new cycle the *hysteresis* time must pass.

After the recognition you can request the passed time:

Time from event1 till query time: delta-T1

Time from event2 till query time: delta-T2

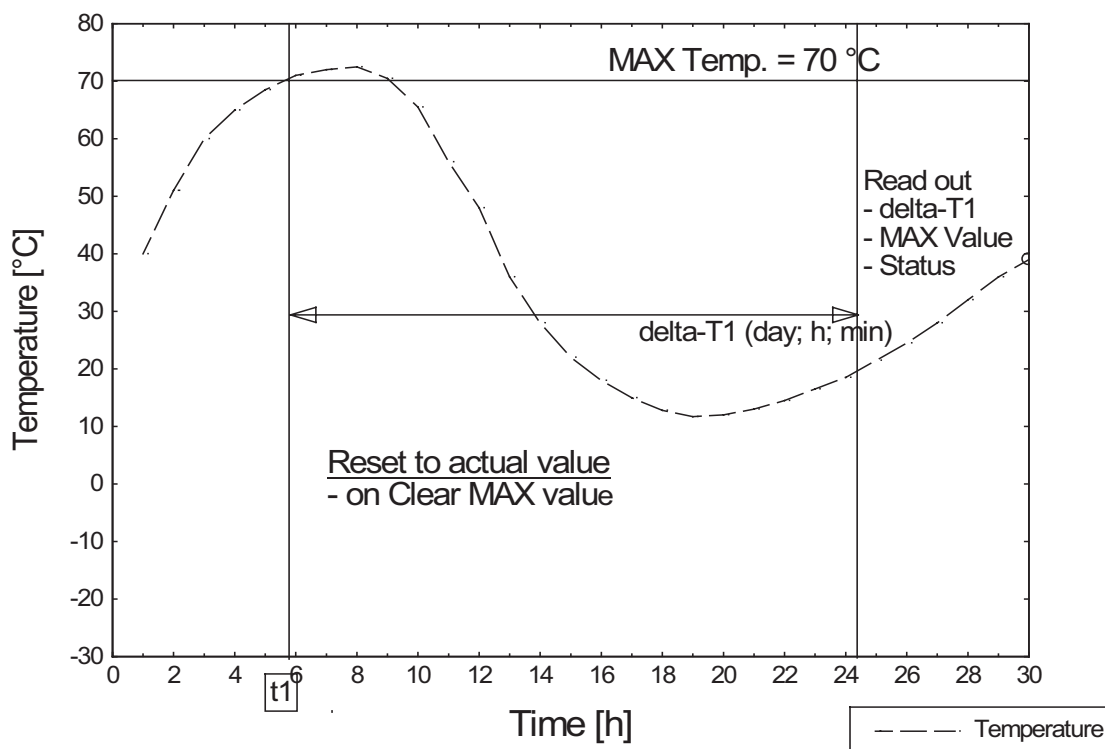
The time difference is the time the upper limit was exceeded.

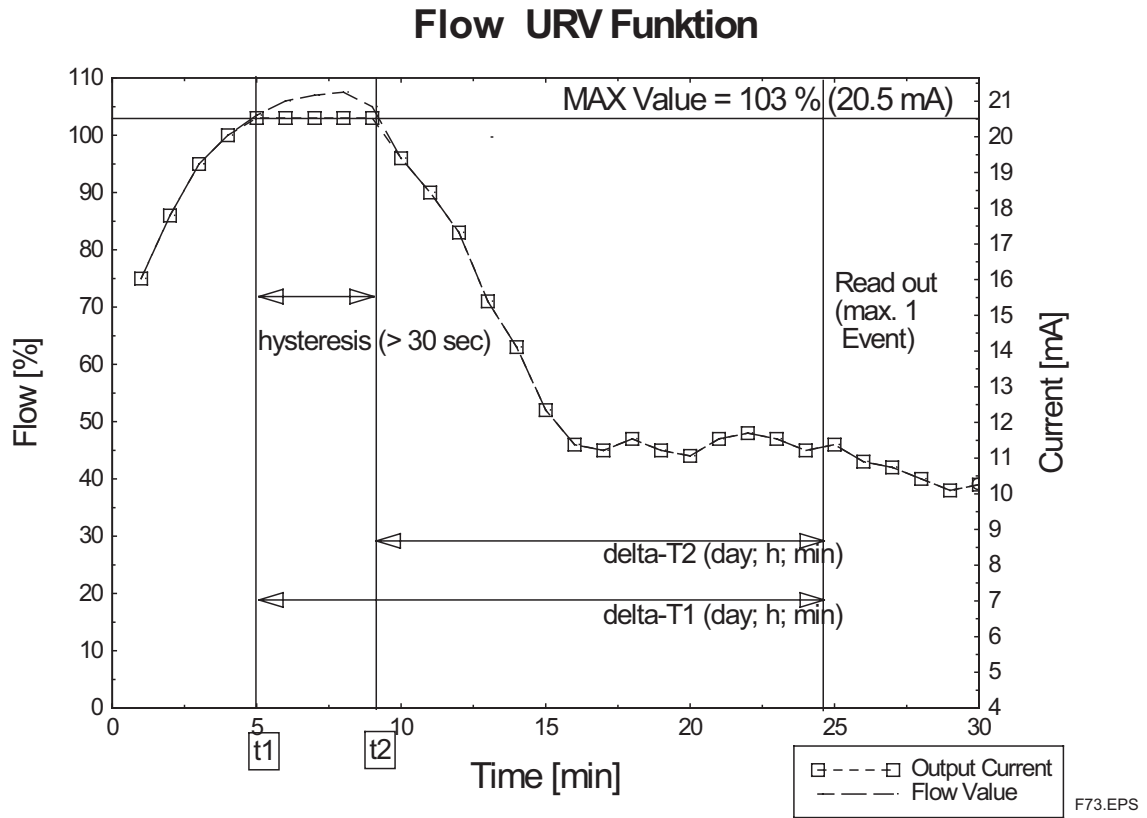
$\text{hysteresis} \leq t \leq (\text{delta-t1} - \text{delta-t2})$

The stored values remain unchanged after power off and must be cleared by the user. The actual cycle is overwritten automatically by a new one. Therefore only the last cycle is always stored.

The default value for hysteresis is 30 seconds.

Temperature MAX function





Device setup			
Diag/Service			
Diagnostics			
Float blocking			
Float blocking	ON/OFF	Activate or deactivate float blocking	
Set lower limit	5%/15%/30%	Set lower limit of supervision range	
Set supervise time	Turbulent flow Smooth flow		
Start autozero	Start		
Autozero value	Shows autozero value		
Detailed description of float blocking function see chapter 6.2.12.			

Device setup			
Diag/Service			
Power monitoring			
Operation time	Days	Time since last power on.	
	Hours		
	Minutes		
Oper time shadow	Days	Time from...	
	Hours	... previous power on...	
	Minutes	... to power off.	
Reset power fail	Power fail warning is cleared.		

Description of power monitoring function:
After power on the minutes are counted in parameter *Operation time*.
At power off the time from parameter *Operation time* is stored in parameter *Oper time shadow*.
After power off/on the power fail warning is set. It can be cleared by *Reset power fail*.

7.4.3 Basic-Setup Menue

Device setup

Basic setup

Tag	Tag Number (8 characters)
Flow unit	Flow measurement unit
Temp unit	Temperature measurement unit
Set damping	Obtained damping
Long tag	Long Tag Number (24 characters)

7.4.4 Detailed-Setup Menue

Device setup

Detailed setup

Characterize meter

Details on the measuring tube.

Snsr unit	Flow measurement unit in accordance with scale
Scale USL	Upper sensor limit related to flow
Snsr s/n	Serial number of the measuring tube
Final assy no.	Number of final assembly
MS Code	Ordering code of the device

Device setup

Detailed setup

Configure signal

Flow damping

Flow damping	Read damping value
Set damping	0.25s/1.00s/5.00s/10.00s

Device setup

Detailed setup

Configure signal

Flow unit table

EU/US	Read preset unit set (see chapter 6-2-2)
-------	--

Device setup

Detailed setup

Configure signal

Flow unit select

Selectable flow units:

EU	US
Cum/h	Cum/h
L/h	NmlCum/h
NmlCum/h	Kg/h
NmlL/h	StdCuFt/h
MetTon/h	CuFt/h
Kg/h	Lton/h
StdCuFt/h	Lb/h
ImpGal/h	gal/h
Cum/min	Cum/min
L/min	NmlCum/min
NmlCum/min	Kg/min
NmlL/min	StdCuFt/min
MetTon/min	CuFt/min
Kg/min	Lton/min
StdCuFt/min	Lb/min
ImpGal/min	gal/min

7. HART-COMMUNICATION

Device setup

Detailed setup

Configure signal

Total reset

Reset totalizer

Device setup

Detailed setup

Configure signal

Temperature unit

degC / degF

Select temperature unit

Device setup

Detailed setup

Configure output

Analog output

Indication, test and adjustment of current output :

Flow AO Read Current output in mA

AO Alm typ Lo è current < 3,6mA at error

Hi è current > 21.0mA at error

Loop Test Set the analogue output fix to 4mA, 20mA or arbitrary current.
Finish with 'End'.

D/A Trim Adjustment of current output at 4mA and 20mA.

Device setup

Detailed setup

Configure output

HART output

HART[®] specific parameter :

Poll Addr Poll Address (Function see above) (Def.: 0)

Num req preams Number of leading FF to HART[®] unit (Def.: 5)

Num resp pream Number of leading FF from HART[®]-unit (Def.:5)

Device setup

Detailed setup

Display selection

Selection of measuring value on display,

Different if manual calibration is activated.

For standard calibration table: Flow / Totalizer / Temperature

For manual calibration table: Percent / Temperature

Device setup**Detailed setup****Device Information**

Unit specific data:	
Model	Model name
Dev ID	Device ID
Manufacturer	Manufacturer
Distributor	Distributor
Snsr s/n	Serial number of the measuring tube
Final assy no	Number of final assembly
Write protect	Write protection
Tag	Type in Tag-Number
Descriptor	Type in description
Message	Type in message
Date	Type Date
Poll addr	Type Poll Address
Num req pream	Number of leading FF to HART ^a - unit
Num rsp pream	Number of leading FF from HART ^a - unit
Long tag	Type in Long Tag-number
MS Code	Ordering code of the device
Revision #'s	Revision numbers:
	Universal rev.: 5
	Fld. Dev. rev.: Field device Revision
	HW rev.: Hardware Revision
	FW rev.: Firmware Revision
	ADJ-EE rev.: Adjustment-EEPROM Revision
	CAL-EE rev.: Calibration-EEPROM Revision

7.4.5 Review**Device Setup****Review**

Model	Model name
Dev id	Device ID
Manufacturer	Manufacturer
Distributor	Distributor
Flow Snsr s/n	Serial number of the measuring tube
Final assy no	Number of final assembly
Write Protect	Write protection
Tag	Tag Number
Descriptor	Description
Message	Message
Date	Date
Poll address	Poll address
Num req pream	Number of leading FF to HART ^a - unit
Num rsp pream	Number of leading FF from HART ^a - unit
Long tag	Type in Long Tag-number
MS Code	Ordering code of the device
Universal rev.:	5
Fld. Dev. rev.:	Field device Revision
HW rev.:	Hardware Revision
FW rev.:	Firmware Revision
ADJ-EE rev.:	Adjustment-EEPROM Revision
CAL-EE rev.:	Calibration-EEPROM Revision

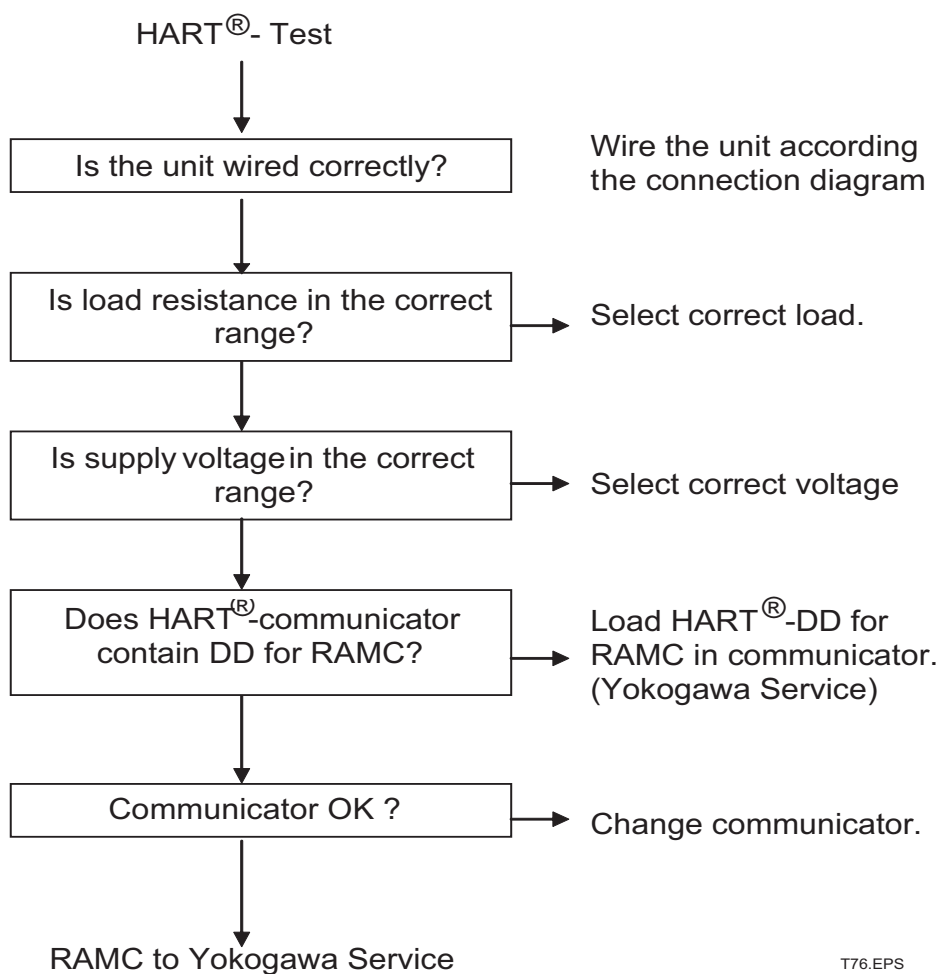
7.5 Maintenance

7.5.1 Function test

- Wire the unit according to the connection diagram.
- Check HART[®]-communication with HART[®]-communicator or with PC with HART[®]-ability communication program.
- Setting: Device setup / Process variables.
- PV AO shows the current value; compare this value with the measured current.

7.5.2 Troubleshooting

Do the following test if problems with HART[®]-units appear :



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8. Maintenance

8.1 Function test

Checking free movement of pointer:

- Remove housing cover (4 screws on housing type 66).
- After deflecting the pointer by hand, it must return to measurement value. If the pointer pivots to different values upon repeated deflections, there is too much friction in the bearings. In this case, send indication unit to service.

Checking free movement of float:

- First, free movement of pointer has to be ascertained.
- Check visually if pointer follows each flow rate change. If not, clean float and measuring tube.

Unit with electronic transmitter:

- The display must show values corresponding to indication function and measuring unit settings.
- The bars under the 8 digits must not flash. If an error occurs, the corresponding countermeasure (refer to section 6-2-8 error messages) has to be taken or the unit has to be sent to service.
- Without flow, the output current must be 0 or 4 mA. At a flow rate of 100% the current must be 20 mA.

Additional function test for HART[®] units (-H)

- check HART[®] communication using a HART[®] Handheld terminal or a PC with HART[®] communication software.
- Setting: Device setup / Process variables
- PV AO shows the current value that should be delivered at output – Check this value using a multimeter.

8.2 Measuring tube, float

The RAMC is maintenance-free. If contamination of the measuring tube impairs the mobility of the float, the tube and the float have to be cleaned. To do this, the RAMC has to be removed from the pipe.

Replacement or cleaning of the float:

- Remove RAMC from the pipe.
- Remove upper retainer from measuring tube.
- Take float stopper and float out through the top of measuring tube.
- Clean float and measuring cone
- Insert float and float stopper into the measuring tube.
- Set retainer into tube.
- Check float for free movement.
- Install RAMC to the pipe.

Attention: Do not expose float to strong alternating magnetic fields. The float and especially its measuring edge must not be damaged.

8.3 Electronic transmitter

The electronic transmitter is maintenance-free. The electronic section is sealed and cannot be repaired. Since the transmitter has been adjusted fully to the mechanical components at the factory, single components can only be replaced with a reduction of the accuracy.

Solely the display and operation unit (LCD PCB) can be replaced. For this the unit has to be sent to service. The current output can be adjusted by means of software. The current output test in section 6.2.11 determines whether an adjustment is necessary. The adjustment is carried out according to section 6-2-6. The power supply PCB of 4-wire units includes a fuse. For fuse replacement be sure to switch off the power supply. Only use fuses with the capacity and characteristic as indicated in the specifications in section 9.3 or as imprinted on the fuse holder.

8.4 Exchange of EEPROM and scale

Preparations:

- Check the commissioning-no., the key-code and the data of the new parts.
- Switch off power supply.
- For units with option /KF1 wait more than 2 minutes before opening the indicator.
- For RAMC with housing type 91 unlock the safety screw at the cover.
- Remove the cover of the indicator unit.
- Make sure that all accessible parts are not under voltage.



IMPORTANT

The pointer may not be twisted or bent on the axis!

Exchange of EEPROM:



WARNING

The calibration-EEPROM can be damaged by electro-static discharge (ESD) . Therefore, only touch insulated parts and never terminals.

The EEPROM is plugged in on the right side of the electrical angle transmitters and safeguarded with a latch (s. fig 3-1 / 3-2).

- Unscrew the screw of the securing latch, but only a few turns!
- Turning the securing latch up, so that the EEPROM can be pulled out.
- Put in the new EEPROM (no wrong positioning possible).
- Turn the securing latch to below above the EEPROM and fix it with the screw.

Exchange of scale at units without limit switches:

- Unscrew the 2 screws of the scale.
- Pulling out the scale of the indicator unit to the left by raising the scale above the 4 corners for units with housing 66. For units with electronic transmitter the scale must additional raised above the 2 buttons.
- Sliding the new scale from the left under the pointer correspondingly until the 4 corner holes click in the footbridges for units with housing type 66 and the 2 buttons click in in the accompanying holes for unit with electronic transmitter.
- Fasten the scale with the 2 screws.

Exchange scale at units with limit switches:

Please, consult to this the service department of ROTA YOKOGAWA.

Final jobs :

- Connect the cover of the indicator.
- For RAMC with housing type 91 lock the safety screw.
- Switch on power supply.
- Check function of the unit.

8.5 Exchange of indicator

The indication units may be replaced by units of the same type, on the condition that the scale of the measuring tube as well as the calibration EEPROM (in case of electronic transmitter) are mounted on the new unit. Operation for units with electronic transmitter (-E / -H) :

- Switch off power.
- For units with option /KF1 wait more than 2 minutes before opening the indicator.
- For RAMC with housing type 91 unlock the safety screw at the cover.
- Unscrew cover of indication unit.
- Disconnect cables and pull them through the cable glands out of the RAMC.
- Remove scale and calibration EEPROM from old indication unit and mount them to new indication unit.



WARNING

The calibration-EEPROM can be damaged by electro-static discharge (ESD) . Therefore, only touch insulated parts and never terminals.

- Do not bend pointer when mounting.
- Mount cover of indication unit.
- Dismount old indication unit from the measuring tube and replace it with a new one. Be sure to mount shims and distance rollers in the same sequence as before disassembled.

8.6 Troubleshooting

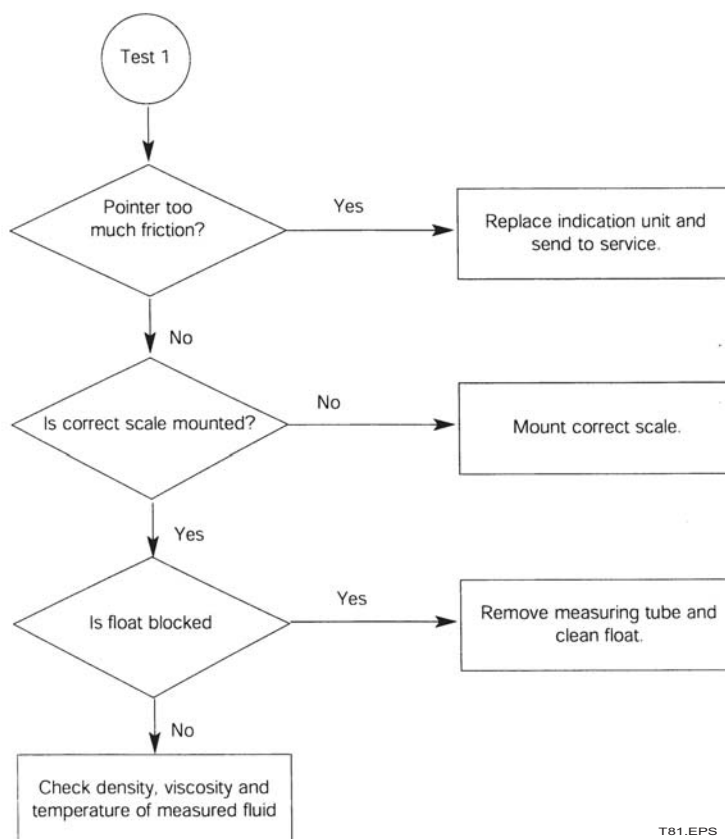
In case the RAMC does not work properly, use the following flow charts for troubleshooting, then check, isolate and remedy the fault.

Precision problems with "T" unit: execute test 1

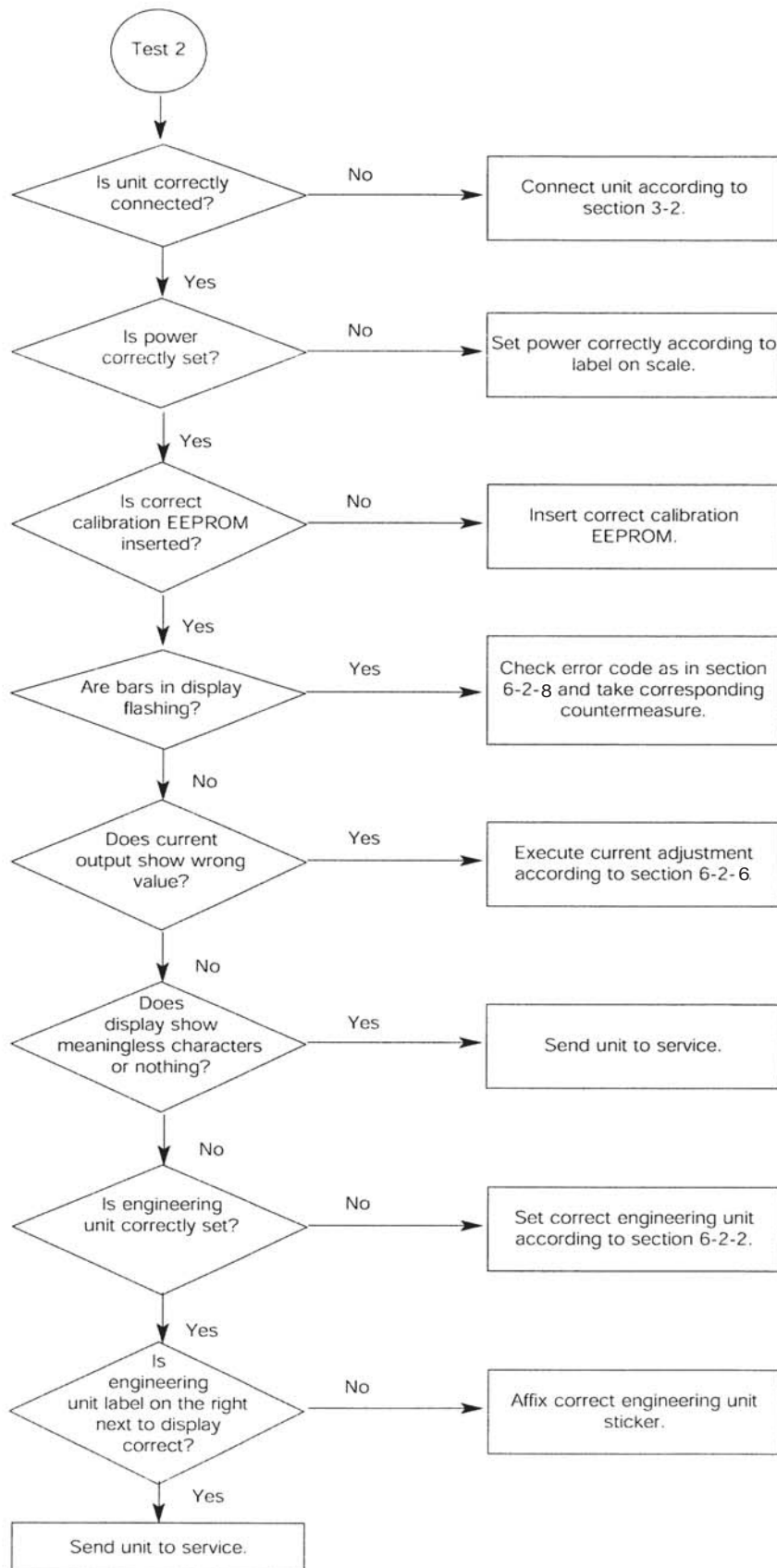
Precision problems with "E" or "H" unit: execute test 1 and test 2

HART[®] communication problems with "H" unit: execute test 3 and see chapter 7.5.

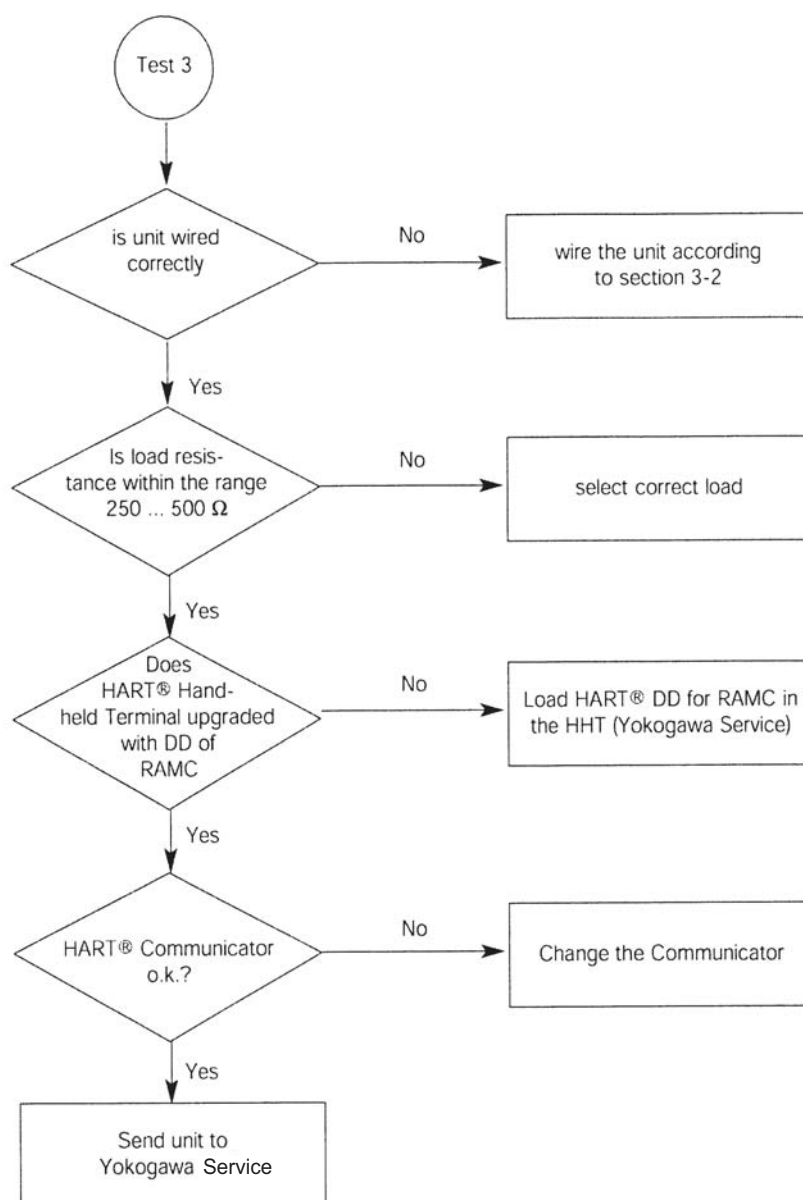
If the indicated countermeasure do not remedy the fault or in case of troubles which cannot be remedied by the user, please contact your YOKOGAWA service centre.



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8. MAINTENANCE

9. Technical Data

9.1 RAMC model- and suffix-codes

Model	Suffix code	Option code	Description	Restrictions
RAMC01	.....	.....	Size DN 15 (1/2 inch)	for D4, D6, A1, A2, A3, T4, R4, T6, G6
RAMC23	.....	.....	Size DN 20 (3/4 inch)	for D4, D6, A1, A2, A3, T4, R4, T6, G6
RAMC02	.....	.....	Size DN 25 (1 inch)	for D4, D6, A1, A2, A3, S2, S4, S5, T4, R4, T6, G6
RAMC03	.....	.....	Size DN 32 (1 1/4 inch)	for D4, D6, A1, A2, A3, S4, T6, G6
RAMC04	.....	.....	Size DN 40 (1 1/2 inch)	for D4, D6, A1, A2, A3, S4, S5, T6, G6
RAMC05	.....	.....	Size DN 50 (2 inch)	for D4, D5, D6, A1, A2, A3, S2, S4, T4, R4
RAMC06	.....	.....	Size DN 65 (2 1/2 inch)	for D4, D5, A1, A2, A3, S2, S4, T4, R4, T6, G6
RAMC08	.....	.....	Size DN 80 (3 inch)	for D4, D5, A1, A2, A3, S2, S4
RAMC09	.....	.....	3 1/2 inch	for A1, A2
RAMC10	.....	.....	Size DN 100 (4 inch)	for D2, D4, A1, A2, S2, S4
RAMC12	.....	.....	Size DN 125 (5 inch)	for D2, A1, A2, S2
RAMC15	.....	.....	Size DN 150 (6 inch)	for D2, A1, A2
RAMCNN	.....	.....	Without measuring tube	
Process connection	-D2 .....	.....	EN flange PN 16, process connection dimensions + facing acc. EN1092 - 1 Form B1	
	-D4 .....	.....	EN flange PN 40, process connection dimensions + facing acc. EN1092 - 1 Form B1	
	-D5 .....	.....	EN flange PN 63, process connection dimensions + facing acc. EN1092 - 1 Form B2	
	-D6 .....	.....	EN flange PN 100, process connection dimensions + facing acc. EN1092 - 1 Form B2	
	-A1 .....	.....	ASME flange class 150, process connection dimensions + facing acc. ASME B16.5	
	-A2 .....	.....	ASME flange class 300, process connection dimensions + facing acc. ASME B16.5	
	-A3 .....	.....	ASME flange class 600, process connection dimensions + facing acc. ASME B16.5	
	-T6 .....	.....	Thread female NPT - PN40	
	-G6 .....	.....	Thread female G : PN40	
	-R4 .....	.....	Thread female Rp : removable	
	-S2 .....	.....	Thread male DIN 11851	
	-S4 .....	.....	Triclamp PN10 ; PN16	
Material of wetted parts	SS .....	.....	Stainless steel	
	PF .....	.....	Teflon lining	
	NN .....	.....	Without wetted parts	Only with RAMCNN
Cone / Float	-nnnn .....	.....	See tables 13 ... 15	
	-NNNN .....	.....	Without measuring tube / without float	Only with RAMCNN
Indicator / Transmitter	-T .....	.....	Indicator local	
	-E .....	.....	Indicator electronic	
	-G .....	.....	Indicator electronic with Profibus PA	Only with output 429
	-H .....	.....	Indicator electronic HART	Only with output 424
	-N .....	.....	Without indicator	Only with housing NN
Housing type	66 .....	.....	Housing rectangular yellow : Polyamid	
	90 .....	.....	Housing round blank : SS	
	91 .....	.....	Housing round yellow : Al	
	NN .....	.....	Without housing	Only with indicator N
Power supply / Output	240 ....	.....	230 V AC : 4-wire : 0-20 mA	Only with indicator E. Not with limit switches
	244 ....	.....	230 V AC : 4-wire : 4-20 mA	Only with indicator E. Not with limit switches
	140 ....	.....	115V AC : 4-wire : 0-20 mA	Only with indicator E. Not with limit switches
	144 ....	.....	115V AC : 4-wire : 4-20 mA	Only with indicator E. Not with limit switches
	430 ....	.....	24V DC : 3-wire : 0-20 mA	Only with indicator E
	434 ....	.....	24V DC : 3-wire : 4-20 mA	Only with indicator E
	424 ....	.....	24V DC : 2-wire : 4-20 mA	Only with indicator E or H
	429 ....	.....	Profibus PA / Foundation Fieldbus 9 ... 32VDC	Only with indicator G. Not with limit switches
	NNN	Without power supply	Only with indicator T or N
Options		/[]	See separate table on next page	

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9.2 Options

Options	Option code	Description	Restrictions
Indicator	/A5	Thread for cable gland ASME 1/2" NPT female	Not with option /A13 Only without indicator; Not with options /KS1, /KF1, /KN1, /SS1, /NS1 Only for indicator E + H Not with option /KF1; not with option /A5 Only for housing 66 + 91 Only for housing 90 + 91 Only for housing 90 Only for housing 90
	/A8	With scale for indicator	
	/A12	US-engineering units	
	/A13	Thread for cable gland ISO M20 x 1.5 female	
	/A14	Housing colour green	
	/A16	Indicator on 95mm extension	
	/A17	Housing colour green	
Marking	/A18	Housing colour yellow	
	/B0	Tag plate (SS) on flange and marking on scale	Plate 12 x 40 mm; max. 45 digits and 8 digits for HART-Tag (only indicator H) Plate 12 x 40 mm; max. 45 digits and 8 digits for HART-Tag (only indicator H) Not with option /P6,/KS1,/KN1,/SS1,/KF1 Plate 12 x 40 mm; max. 45 digits and 8 digits for HART Adjustment only for 1 fluid possible
	/B1	Tag plate (SS) fixed by wire and marking on scale	
	/B4	Neutral version	
	/B8	Customer provides marking on label	
	/BG	Customer specific notes on scale	
Limit switches	/BD	Dual Scale	Not for power supply 14n + 24n Not for power supply 14n + 24n Not for power supply 14n + 24n Not for power supply 14n + 24n Not for power supply 14n + 24n Not for power supply 14n + 24n Not for power supply 14n + 24n
	/K1	MIN-contact	
	/K2	MAX-contact	
	/K3	MIN-MAX-contact; MIN-MIN-contact; MAX-MAX-contact	
	/K6	MIN-contact "Fail Safe"- version	
	/K7	MAX-contact "Fail Safe"- version	
	/K8	MIN-MAX-contact "Fail Safe"- version	
Pulse output	/K9	MIN-MIN contact "Fail Safe"- version	Not for power supply 14n + 24n Not for power supply 14n + 24n
	/K10	MAX-MAX-contact "Fail Safe"- version	
	/CP	Pulse output, isolated	
Facing (process connection)	/D10	EN raised face B2 : Ra 0.8 - 3.2	Only for EN-flanges (D2;D4) Only for EN-flanges (D2;D4)
	/D11	EN groove	
Ex-proof type	/KS1	ATEX intrinsically safe "ia"	Only for power supply 434+430+424+429; for indicator T only with limit switches Only for power supply 434+430+424; for indicator T only with limit switches Only for power supply 424; for indicator T only with limit switches Only for power supply 424; for indicator T only with limit switches /K6 to /K10; only for housing 90 Only for power supply 424, 430, 434; only for indicator E + H; only for housing 90; Limit switches only with indicator E + H Only for housing 91; only for power supply 434+430+424
	/KN1	ATEX category 3G "nL" / 3D	
	/FS1	FM intrinsically safe approval for electronic transmitter, CSA intrinsically safe approval for limit switches (USA and Canada)	
	/SS1	SAA approval (Australia)	
	/NS1	NEPSI approval (China)	
	/KF1	ATEX flame proof "d" / dust proof	
Test and certificates	/H1	Oil + fat free for wetted surfaces acc. ASTM G93-03, level C	Only for metallic pressurized parts
	/H3	Certificate pure water application	
	/P2	Certificate of Compliance with the order acc. to EN 10204: 2004- 2.1	
	/P3	As /P2 + Test report acc. to EN 10204: 2004- 2.2	
	/P6	Material certificate acc. to EN 10204: 2004- 3.1	
	/PP	Certificate hydro static pressure	
	/PT	Flowtable for conversion	
Damping	/SD	Float damping system	Only for stainless steel; not for cone 81 + 82; only for gas application
Heat tracing	/T1	Heat tracing, process connection R 1/4"	Only for SS material of wetted parts Only for SS material of wetted parts Only for SS material of wetted parts Only for SS material of wetted parts Only for SS material of wetted parts Only for SS material of wetted parts
	/T2	Heat tracing, process connection DN15 PN40	
	/T3	Heat tracing, process connection DN25 PN40	
	/T4	Heat tracing, process connection ASME 1/2" 150#	
	/T5	Heat tracing, process connection ASME 1" 150#	
	/T6	Heat tracing, process connection 1/4" NPT	
Power supply for electronic transmitter	/U2F	SINEAX B811, 85 - 250 V AC, EEx i	Only for indicator E + H Only for indicator E + H Only for indicator E + H Only for indicator E + H
	/U3F	SINEAX B811, 24 V AC/DC, EEx i	
	/U2K	SINEAX B811, 85 - 250 V AC, EEx i, HART compatible	
	/U3K	SINEAX B811, 24 V AC/DC, EEx i, HART compatible	
Power supply for limit switch(es) (transmitter relay)	/W1A	KFA5-SR2-Ex1.W / 115 V AC, 1 channel	Only for limit switches /K1 + /K2 + /K3 Only for limit switches /K1 + /K2 + /K3 Only for limit switches /K1 + /K2 + /K3 Only for limit switches /K1 + /K2 + /K3 Only for limit switches /K6 to /K10 Only for limit switches /K1 + /K2 + /K3 Only for limit switches /K1 + /K2 + /K3 Only for limit switches /K6 to /K10
	/W1B	KFA5-SR2-Ex2.W / 115 V AC, 2 channels	
	/W2A	KFA6-SR2-Ex1.W / 230 V AC, 1 channel	
	/W2B	KFA6-SR2-Ex2.W / 230 V AC, 2 channels	
	/W2E	KHA6-SH-Ex1 / 230 V AC, 1 channel, Fail Safe	
	/W4A	KFD2-SR2-Ex1.W / 24 V DC, 1 channel	
	/W4B	KFD2-SR2-Ex2.W / 24 V DC, 2 channels	
Flange protection	/W4E	KHD2-SH-Ex1 / 24 V DC, 1 channel, Fail Safe	
	/QK	Flange covers (flange EN)	Only for flange EN
Instruction manuals	/IE n	Quantity of instruction manuals in English	n = 1 to 9 selectable *) n = 1 to 9 selectable *) n = 1 to 9 selectable *) *) if no instruction manual is selected, only a CD with instruction manuals is shipped with the flowmeter
	/ID n	Quantity of instruction manuals in German	
	/IF n	Quantity of instruction manuals in French	

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9.3 Standard Specifications

METERING TUBES

Materials of wetted parts

- : - Stainless steel AISI 316L (1.4404)
- PTFE
- other materials on request

Measurable fluids : suitable for a variety of liquids, gas and steam

Measuring range : see tables 9-7 and 9-8

Measuring range ratio
: 10:1

Process connections / Stainless steel

- Flanges : - acc. EN1092-1
DN15 – DN100 PN40
DN100 – DN150 PN16
- acc. ASME B 16.5
1/2" – 6" class 150 raised face
1/2" – 6" class 300 raised face
- Roughness of sealing: RA 3,2 bis 6,3
- Threated connection
- male acc. DIN 11851
- NPT- female,
- G- female
- Clamp acc. DN25/1" – DN100/4"

Process pressure : depends on process connection
see table 9-8; higher pressure
(up to 700 bar) on request

Process temperature :

- medium wetted parts made of stainless steel
: -180 ... +370°C
- medium wetted parts made of PTFE
: -80 ... +130°C

Accuracy class

acc. VDI / VDE 3513, sheet 2
Table 9-1

Material of wetted parts	Size	Accuracy class acc. VDE/VDI 3513 edition 12/1978	Standard flow accuracy: full scale
SS	DN 15 - 100	1.6	± 1.6%
SS	DN 125 - 150	2.5	± 2.5%
PTFE	DN 15 - 100	2.5	± 2.5%

TO EPS

Pressure Equipment Directive (PED) Directive 97/23/EG

- Modul : H
- Fluid Group : 1
- produced acc. category : III

Installation

- Mounting direction : vertical
- Flow direction : upwards
- Mounting length : see table 9-6 to 9-8
- Straight pipe inlet length
: DN 80/100 at least 5D,
not necessary for smaller sizes

Transportation- and Storage condition

- Local indicator : -40°C to +110°C
- Electronic transmitter : -40°C to +70°C

Weight : see table 9-10

LOCAL INDICATOR

(Indicator/Transmitter Code –T)

Principle

- : The indication is made by magnetic coupling of a magnet enclosed in the float and a magnet in the indication unit, which follows the movements of the float.

Indicator housing

- Materials : - Stainless steel (1.4301)
- painted aluminium casting
- painted Polyamid with fiberglass each with safety-glass window
- Degree of protection : - IP65 (housing type 66 and 90)
- IP66/67 (housing type 91)

Scales

- Standard : removable aluminium plate with scale (double scale as option)
- Marking : direct readable units or percentage of Q_{max}.

Process-/

Ambient temperature

- : see fig. 9-11 to 9-14

9. TECHNICAL DATA

ELECTRONIC TRANSMITTER

(Indicator/Transmitter Code -E, -H, -G)

Standard type (Code -E) :

Power supply :

- 4-wire units with galvanic isolation :
 - 230 V AC +10 %/-15 %, 50/60 Hz, fuse 0.063 A, time lag, (5x20) mm
 - 115 V AC +10%/-15 %, 50/60 Hz, fuse 0.125 A, time lag, (5x20) mm
- 2/3-wire units : - U = 13.5 V... 30 V DC

Output signal :

- 4-wire units :
 - 0 - 20 mA, 4 - 20 mA
 - pulse output (option /CP) max. frequency 4 Hz see fig. 3
 - 3-wire units : 0 - 20 mA, 4 - 20 mA
 - 2-wire units : 4 - 20 mA
- The 20mA point is selectable between 60% and 100% of Q_{nom} .

Load resistance :

- 4-wire units : $\leq 500 \Omega$
- 2/3-wire unit : $\leq (U-13.5 \text{ V})/20 \text{ mA}$

HART- communication type (Code -H) :

Power supply :

- 2-wire units : - U = 13.5 V... 30 V DC

Output signal :

- 2-wire units : 4 - 20 mA

Profibus PA - communication type (Code -G) :

- 2-wire bus connection not polarity sensitive : 9 ... 32V DC acc. to IEC 61568-2 and FISCO model
- Basic current : 18mA
- Failure current (FDR) : 10mA additional to basic current
- Transmission rate : 31.25 kBaud
- AI block for volume flow or mass flow
- Configurable with PDM DD
- Supports I&M-functions

Digital display :

8-digits 7-segment-LC-display character height 6 mm

Process-/ Ambient temperature :

The dependency of the process temperature from the ambient temperature is shown in fig. 6a to fig. 6d.
The internal temperature of the electronic transmitter can be indicated on the display or checked via HART communication.

Measurement of the internal transmitter temperature :

- Range : -25 °C to +70 °C
- Accuracy : $\pm 5 \text{ °C}$

Storage temperature :

-40 °C to +70 °C

Linearity :

$\pm 0.2 \text{ % f.s.}$

Hysteresis ¹⁾ :

$\pm 0.1 \text{ % f.s.}$

Repeatability ¹⁾ :

$\pm 0.1 \text{ % f.s.}$

Influence of power supply ¹⁾ :

$\pm 0.1 \text{ % f.s.}$

Temperature coefficient of the output signal ¹⁾ :

$\pm 0.5 \text{ %/10 K f.s.}$

AC-part of output signal ¹⁾ :

$\pm 0.15 \text{ % f.s.}$

Long-time stability ¹⁾ :

$\pm 0.2 \text{ % /year}$

Max. output signal :

21.5 mA

Output signal in case of failure :

$\leq 3.6 \text{ mA}$ (acc. NE 43)

Response time (99%) :

About 1.5 s (damping 1s)

¹⁾ at 20°C ambient temperature

Electromagnetic compatibility (EMC) :

- Emission acc. EN 55011: 2003 : class A, group 1
- EN 61000-3-2 : 2001
- EN 61000-3-3 : 2002
- Immunity acc. EN 61326 : 2002 :
Criterion A, restriction : HF-immunity between 500 MHz and 750 MHz : criterion B

Unit safety acc. DIN EN61010-1 : 2002

- Overvoltage category : II (acc. VDE 0110 or IEC 664)
- Pollution degree : I
- Safety class :
 - I (with 115 / 230V AC power supply)
 - III (with 24V DC power supply and Fieldbus type)

POWER SUPPLY FOR ELECTRONIC TRANSMITTER

(Option /U__)

Type :

power supply with galvanically separated input and output

- SINEAX B811, HART- compatible type available

Supply voltage :

- 24 V to 60 V AC/DC
- 85 V to 230 V AC

Maximum load :

750 Ω

Output signal :

0/4 mA - 20 mA

CABLE GLAND (for transmitter -E, -H and -G) :

Size :

- M16x1.5 (standard)
- Thread M20x1.5 (option /A13; standard for option /KF1)
- Thread 1/2" NPT (option /A5)

Cable diameter :

6 - 9 mm

Maximum cross section of core :

$\varnothing 1.5 \text{ mm}^2$

LIMIT SWITCHES IN STANDARD VERSION

(option /K1 to /K3)

Type :

Inductive proximity switch S 3.5-NO acc. DIN EN 60947-5-6

Nominal voltage :

8 V DC

Output signal :

$\leq 1 \text{ mA}$ or $\geq 3 \text{ mA}$

LIMIT SWITCHES IN FAIL SAFE VERSION

(option /K6 to /K10)

Type :

Inductive proximity switch SJ3.5-SN; SJ3.5-S1N acc. DIN EN 60947-5-6 (NAMUR)

Nominal voltage :

8 V DC

Output signal :

$\leq 1 \text{ mA}$ or $\geq 3 \text{ mA}$

HYSTERESIS OF LIMIT SWITCHES

Min-contact :

- pointer movement : $\approx 0.5 \text{ mm}$
- float movement : $\approx 0.8 \text{ mm}$

Max-contact :

- pointer movement : $\approx 0.5 \text{ mm}$
- float movement : $\approx 0.6 \text{ mm}$

CABLE GLAND (option /K1 to /K10)**Size :**

- M16x1.5 (standard)
- Thread M20x1.5 (option /A13; standard for option /KF1)
- Thread ½" NPT (option /A5)

Cable diameter :

6 – 9 mm

Maximum cross section of core :Ø 1.5 mm²**POWER SUPPLY FOR LIMIT SWITCHES**

(Option /W__)

Type :

Transmitter relay acc. DIN EN 50227 (NAMUR)

- KFA6-SR2-Ex1-W (230 V AC)

- KFA5-SR2-Ex1-W (115 V AC)

- KFD2-SR2-Ex1-W (24 V DC)

Power supply :

- 230 V AC ± 10%, 45-65Hz

- 115 V AC ± 10%, 45-65Hz

- 24 V DC ± 25%

Relay output :

1 or 2 potential-free changeover contact(s)

Switching capacity :

max. 250V AC, max. 2 A

SWITCHING LEVELS FOR LIMIT SWITCHES**Table 2 Limit switch as Min, Max and Min-Max-contact in standard and fail-safe version.**

		SC 3,5-N0		SJ 3,5-SN		
Function	Pointer	Switch	Signal	Switch	Signal	Fail safe
MAX	above LV	on	1mA	on	1mA	1mA
	below LV	off	3mA	off	3mA	
MIN	above LV	off	3mA	off	3mA	1mA
	below LV	on	1mA	on	1mA	

Note : LV = Limit value

T2.EPS

Table 3 Limit switch as Min-Min-contact in standard and fail-safe version.

		SJ 3,5-SN		SJ 3,5-S1N		
Function	Pointer	Switch	Signal	Switch	Signal	Fail safe
upper MIN	above LV	-----	-----	off	3mA	1mA
	below LV	-----	-----	on	1mA	
lower MIN	above LV	off	3mA	-----	-----	1mA
	below LV	on	1mA	-----	-----	

Note : LV = Limit value

T3.EPS

Table 4 Limit switch as Max-Max-contact in standard and fail-safe version.

		SJ 3,5-SN		SJ 3,5-S1N		
Function	Pointer	Switch	Signal	Switch	Signal	Fail safe
upper MAX	above LV	on	1mA	----	----	1mA
	below LV	off	3mA	----	----	
lower MAX	above LV	----	----	on	1mA	1mA
	below LV	----	----	off	3mA	

Note : LV = Limit value

T4.EPS

Note :

If 2 Fail-Safe limit switches option /K6 ... /K10 are used in a RAMC also 2 power supplies option /W2E or /W4E are necessary.

9. TECHNICAL DATA

Process connection tables for metal tubes (Table 9.6)

Pos		Process connection																										Cone Float combination Code																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
		EN-Flange										ASME-Flange										Male thread DIN11851 PN16/PN25/PN40	Calimp Clamp PN10/PN16	Female thread					Flange																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
		Form B1					Form B2					with groove(Opt.: D11)					Form B2 (Opt.: D10)							150lbs			300lbs			600lbs			PN10-PN25		Female thread		Rosista PN10																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
		PN16	PN40	L ⁽¹⁾	PN63	D5	PN100	L ⁽¹⁾	PN16	PN40	L ⁽¹⁾	PN16	PN40	D2	D4	D6	L ⁽¹⁾	PN16	PN40	D2	D4			D6	L ⁽¹⁾	PN16	PN40		D2	D4	D6	L ⁽¹⁾	PN16	PN40	NPT	G																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
		Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code			Code	Code	Code	Code		Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	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(1) L = face to face length

(2) Accuracy class 2,5 instead 1,6

Flow table for metal tubes (Table 9.7)

Pos.	Measuring ranges for water and liquids						
	recommended combination				Alternative combination		
	Max. Flow		Cone / Float combination		Cone / Float combination		pressure loss a)
	m ³ /h ^{c)}	gpm ^{d)}	Code	viscosity mPa*s ^{b)}	Code	viscosity mPa*s ^{b)}	pressure loss a)
1	0.025	0.11	43 S0	10	-	-	-
	0.04	0.18	44 S0	80	-	-	-
	0.063	0.28	47 S0	40	-	-	-
	0.1	0.45	51 S0	80	-	-	-
	0.13	0.55	53 L1	12	-	-	-
2	0.16	0.7	-	-	53 M1	15	100
	0.22	0.5	54 L1	12	-	-	-
	0.25	1.12	53 S1	40	54 M1	15	50
	0.32	1.4	-	-	57 L1	12	50
	0.4	1.8	54 S1	40	57 M1	15	50
	0.5	2.2	-	-	61 L1	12	50
	0.63	2.8	57 S1	40	61 M1	15	100
	0.8	3.5	-	-	62 L1	12	50
	1.0	4.5	61 S1	40	62 M1	15	100
	1.6	7.0	62 S1	40	-	-	-
	2.3	10.4	-	-	62 V1	45	50
	1.3	5.7	63 L2	17	-	-	-
	2.1	9.2	-	-	64 L2	17	50
3	2.5	11.2	63 S2	42	64 M2	17	10
	4	18	64 S2	42	-	-	-
	6	27	-	-	64 V2	43	20
	3.2	14	67 L5	13	20	-	-
	5.0	22	-	-	71 L5	13	30
4	6.3	28	67 S5	47	-	-	-
	8.5	37	-	-	72 L5	13	30
	10	45	71 S5	47	72 M5	19	5
	16	70	72 S5	47	-	-	-
	25	110	-	-	72 V5	63	5
	25	110	73 V8	60	-	-	-
5	40	180	74 V8	60	-	-	-
	63	280	77 V8	60	-	-	-
	100	450	81 V1	70	-	-	-
6	130	570	82 V1	70	-	-	-
	-	-	-	-	-	-	-

T8.EPS

a) Pressure loss at the float with water or air.

b) For higher viscosity, the specified precision is no more guaranteed.

c) Flow is referred to 20°C and 1 bar abs

d) Flow in US Gallons per minute at 70°F

e) Flow referred to 0°C and 1.013 bar abs at operation conditions of 20°C and 1.013 bar abs

f) Flow in Standard cubicfeet per minute referred to 60°F and 14.7PSI at operation conditions of 70°F and 14.7 PSI abs

For your special application please use the Rota Yokogawa Sizing-Program

Process connection and flow table for tubes wit PTFE lining (Table 9.8)

Pos.	Process connection						Measuring range for Water / Liquids						Measuring range for Air / Gases			
	EN-Flange			ASME-Flange			Max. Flow m ³ /h ^{c)}	Cone / Float combination	Pressure Loss ^{a)} mbar	Visco- sity ^{b)} mPa*s	Max. Flow m ³ /h ^{c)}	Cone / Float combination	Pressure loss ^{a)} mbar	Max. Flow m ³ /h ^{c)}	Cone / Float combination	Pressure loss ^{a)} mbar
	PN 16	Code	D4	L ⁽¹⁾ [mm]	150 lbs	300 lbs										
					Code	L ⁽¹⁾ [mm]										
2	D2				A1		0,1	0,45	51 A1	16	50			3,5		
							0,16	07	52 A1	16	50			5,0		
							0,25	1,12	53 A1	16	50			8,5		
							0,4	1,8	54 A1	16	50			13		
3							0,63	2,8	57 A1	16	50			20		
							1,0	4,5	61 V1	18	50			34		
							1,6	7,0	62 A2	20	30			50		
							2,5	11,2	63 A2	20	30			85		
4							4,0	18	63 V2	22	20			-		
							4,0	18	64 A5	20	30			130		
							6,3	28	67 A5	20	30			200		
							10	45	71 A5	20	30			350		
5							16	70	71 V5	22	10			-		
							16	70	72 V8	25	10			500		
							25	110	73 V8	25	10			850		
							40	180	74 V8	25	10			-		
6	DN100	DN80	DN100	250	4"	270	63	280	77 10	30	10			-		

Bold = recommended

(1) L = Mounting length

a) Pressure loss at the float with water or air.

b) As from this viscosity the specified precision is no more guaranteed.

c) Flow is referred to 20°C and 1 bar abs

d) Flow in US Gallons per minute at 70°F

e) Flow referred to 0°C and 1.013 bar abs at operation conditions of 20°C and 1.013 bar abs

f) Flow in Standard cubicfeet per minute referred to 60°F and 14,7 PSI at operation conditions of 70°F and 14,7 PSI abs

For your special application please use the Rota Yokogawa Sizing-Program

9.4 Dimensions and weights

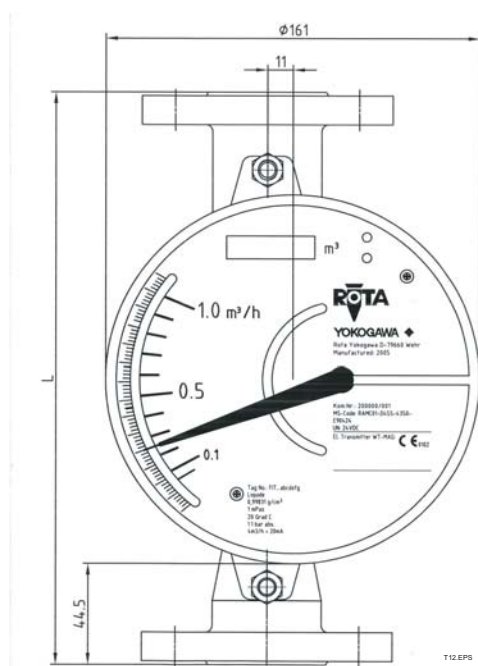


Fig. 9.1. Front view type 90

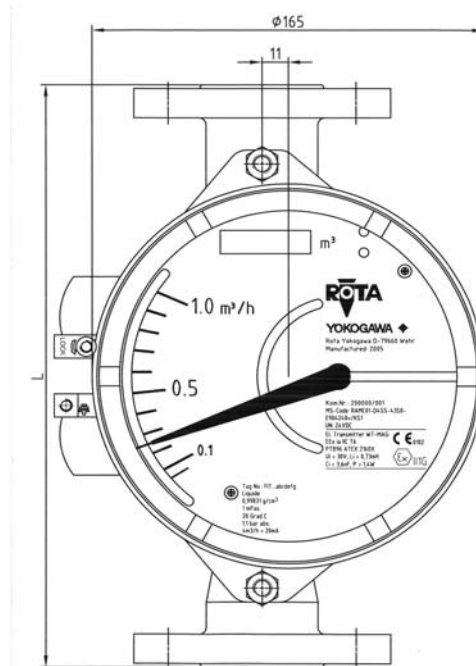


Fig. 9.2. Front view type 91

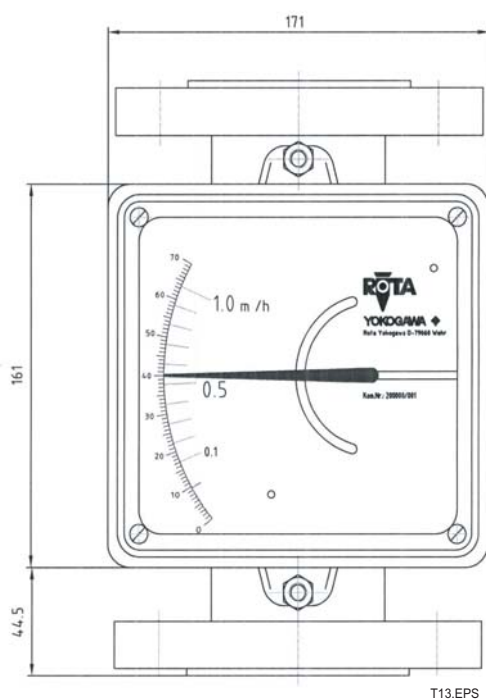


Fig. 9.2. Front view type 66

9. TECHNICAL DATA

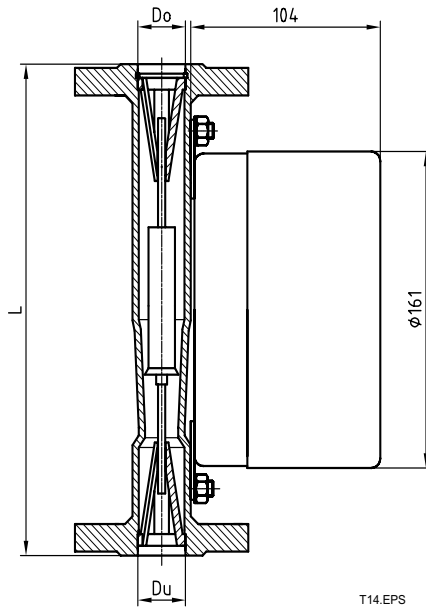


Fig. 9.4 Metal version

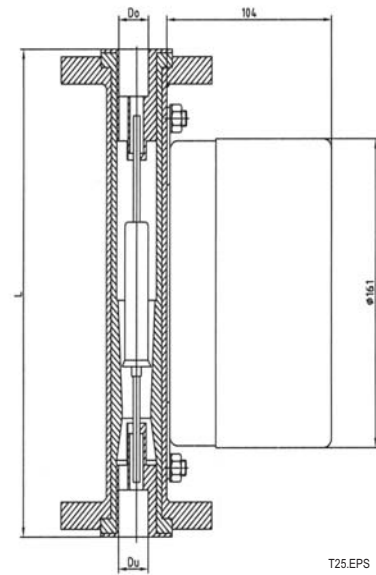


Fig. 9.5 Metal version with lining

Inner diameter of stainless steel flanges								Inner diameter of flanges with PTFE-lining			
Pos. *)	EN- flange without groove			ASME- flange			Rosista- flange	Pos. *)	EN- flange	ASME- flange	Du = Do
	Size	Du mm	Do mm	Size	Du mm	Do mm			Size	Size	
1	DN15 - DN50	20.7	20.7	1/2" - 1"	20.7	20.7	20.7				
2	DN15 - DN50	29.5	29.5	1/2"	20.7	20.7	29.5	2	DN15 - DN25	3/4" - 1"	23.5
				3/4" - 2"	29.5	29.5					
3	DN25 - DN50	45.2	45.2	1"	32.2	32.2	45.2	3	DN25 - DN50	1 1/4" - 1 1/2"	36.0
				1 1/4" - 2"	45.2	45.2					
4	DN50 - DN100	62.0	76.0	2"	62.0	65.5	-	4	DN50 - DN80	2 1/2" - 3"	66.0
				2 1/2" - 3"	62.0	76.0					
5	DN80 - DN150	94.0	94.0	3" - 6"	94.0	94.0	-	5	DN80 - DN100	3 1/2" - 4"	82.0
6	DN100 - DN150	116.0	116.0	4" - 6"	116.0	116.0	-	6	DN100	4"	110.0

*) see table 12; 13; 14

T23.EPS

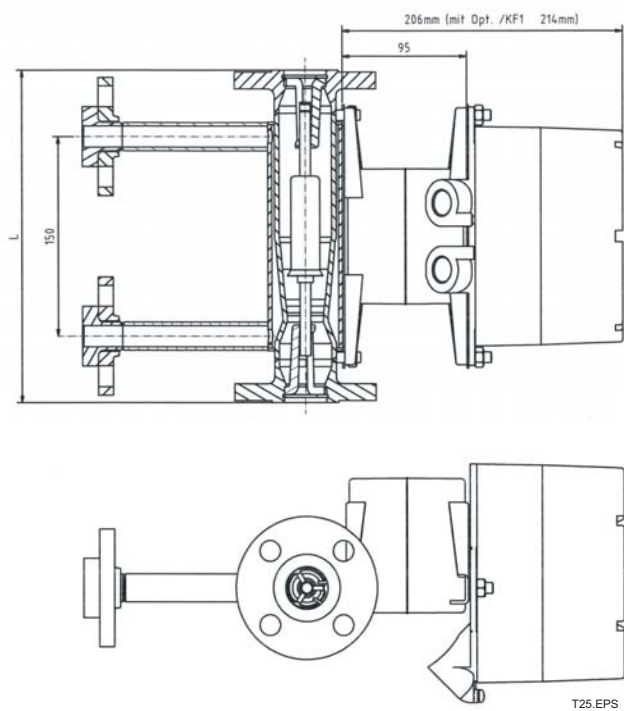


Fig. 9.6 RAMC type 91 and option /A16 and /T2

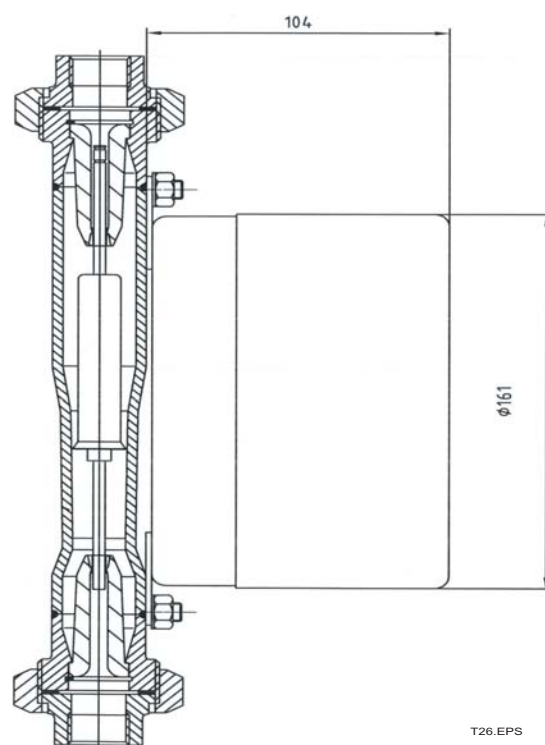


Fig. 9.7 RAMC twith connection R4 / T4

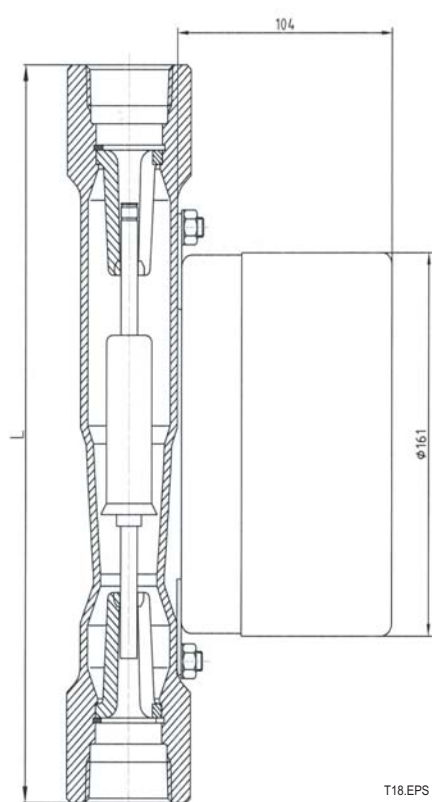


Fig. 9.8 RAMC with connection T6/ G6

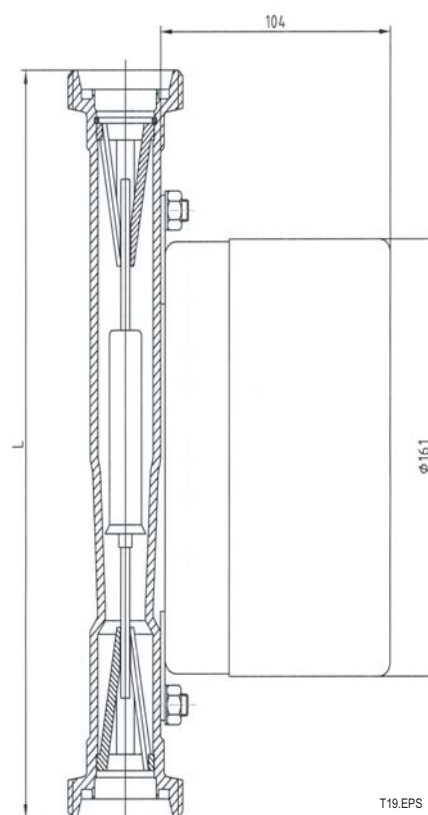


Fig. 9.9 RAMC with connection S2

9. TECHNICAL DATA

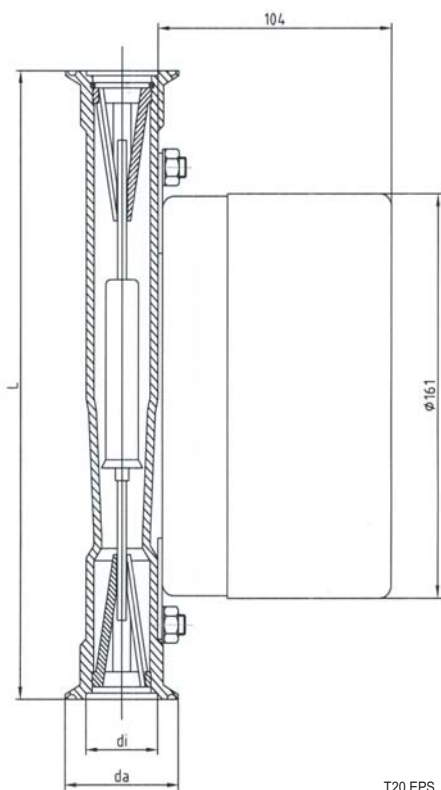


fig. 9.10 RAMC with connection S4

Table 9.9 Diameter for connection sizes S4

Position *)	Size [mm]	di [mm]	da [mm]
1	DN25 / 1"	36	50.5
	DN32	36	50.5
	DN40 / 1-1/2"	36	50.5
2	DN25 / 1"	36	50.5
	DN32	36	50.5
	DN40 / 1-1/2"	36	50.5
3	DN50 / 2"	47,8	64
4	DN65	72.1	91
	3"	72.1	91
5	DN100 / 4"	97.6	119

*) see table 12;13,14

T21.EPS

Table 9.10 Weights

Position *)	Weight / kg
1	3 - 5
2	3 - 5
3	6.5 - 8
4	8.6 - 11
5	13 - 16
6	17 - 20

*) see table 12;13,14

Indicator on extension (option /A16)
additional 1 kg

T22EPS

9.5 Temperature graphs for RAMC metal design, standard and Ex-i

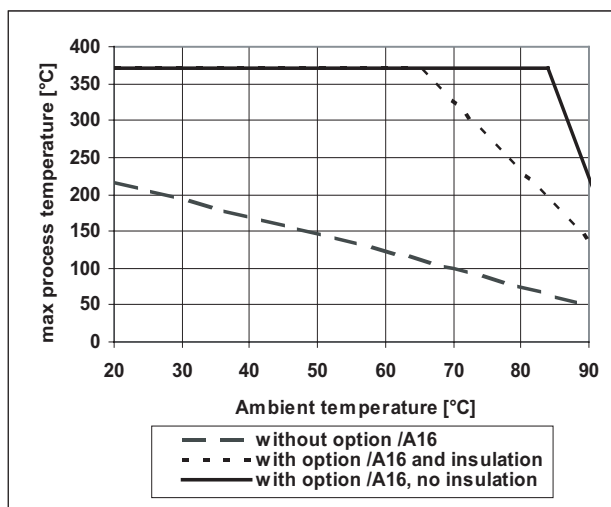


fig. 9.11 RAMC : - type 90 / 91
- only with indicator

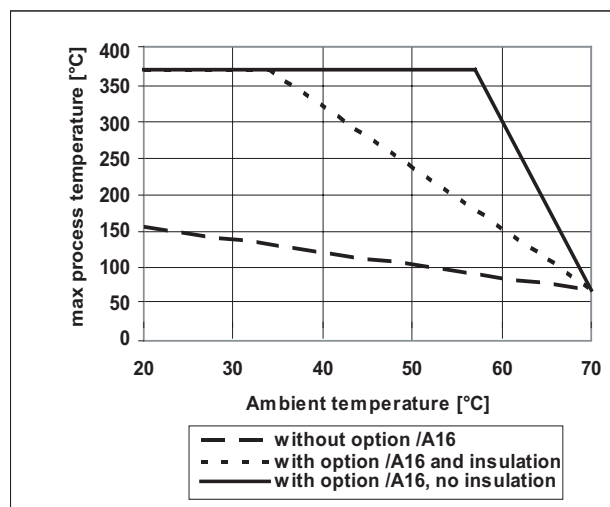


fig. 9.12 RAMC : - type 90 / 91
- with limit switches
- with electronic transmitter

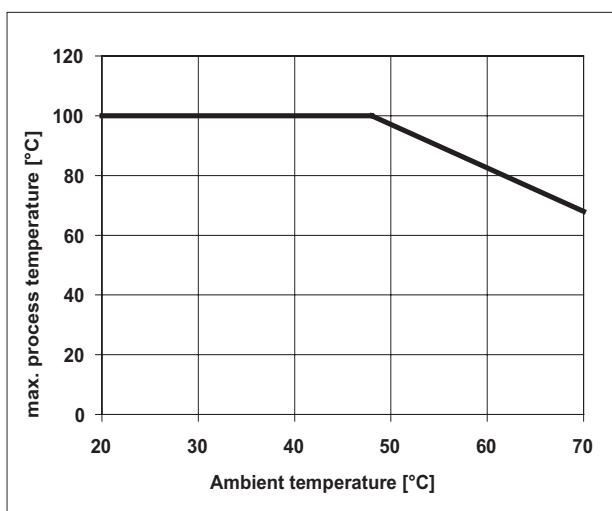


fig. 9.13 RAMC : - type 66
- with or without limit switches
- with or without electronic transmitter

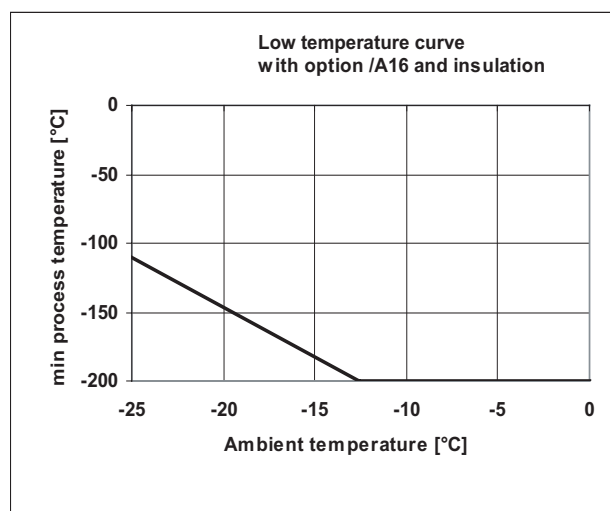


fig. 9.14 RAMC : - type 90 / 91
- with or without limit switches
- with or without electronic transmitter

T10.EPS

The temperature graphs are reference values for size DN100. They may be influenced negative by damed heat, external heat sources or radiated heat and influenced positive for smaller sizes.

Insulation means rockwool between tube and indicator.

Units with electronic transmitter can show the temperature of the internal transmitter on the display or HART-type can show and supervise the internal temperature by HART-communication.

Units with PTFE lining are usable up to 130 °C.

For units with intrinsic safe transmitter the temperature limits according the certificate of conformity must be regarded.

The minimum ambient temperature for all indicators is -25 °C (lower temperatures on request).

10. Explosion-protected Type Instruments

10.1 General

10.1.1 Intrinsic safety



WARNING

To ensure intrinsic safety it is not permitted to repair or to modify the electronic transmitter, the display, the limit switches or the calibration EEPROM.

The electronic transmitters type -E/□S1, -H/□S1 and -G/□S1 of the RAMC as well as the limit switches (option /K□ with option /□S1) are intrinsically safe devices.

Power supply for the electronic transmitter and transmitter relay for the limit switches are associated apparatus and should be installed outside any hazardous area.

The electronic transmitter must be connected to an intrinsically safe, certified power supply with a maximum voltage and output power below the maximum values of the electronic transmitter (refer to Technical data, in the concerning chapters). The combined internal inductance and capacity of the electronic transmitter and connecting cables must be less than the permitted external inductance and capacity of the power supply.

Accordingly, the limit switches have to be connected to intrinsically safe, certified isolating switching amplifiers. The relevant maximum safety values must be heeded at all times.

Especially in the case of high fluid temperatures, heated metering tubes or heat radiation by heat tracing, make sure that the temperature in the indicator housing does not exceed the permissible maximum ambient temperature of the transmitter (refer to Technical data, chapter 9).

10.1.2 Flame proof

In the RAMC with option /KF1 the transmitter and the limit switches are mounted in a flame proof housing. Wait 2 minutes after switching power off before opening the cover.

The cover can only be opened after loosening the safety screw.

After closing the cover the safety screw must be fixed before switching power on.

The RAMC with option /KF1 shall be connected up via suitable cable glands and / or conduit systems that satisfy the requirements of EN 50018 or 60079-1 sections 13.1 and 13.2 and for which a separate test certificate is available. Cable glands and entry fittings (screwed conduit entries) as well as blanking plugs of simple design may not be used. On connection of the RAMC /KF1 using a conduit entry approved for the purpose, the associated sealing facility must be arranged directly on the housing.

Unused openings must be closed off as defined in EN 50018 section 11.9 (e.g. certified blanking elements).

The RAMC with option /KF1 shall be connected to the local equipotential grounding system.

Especially in the case of high fluid temperatures, heated metering tubes or heat radiation by heat tracing, make sure that the temperature in the indicator housing does not exceed the permissible maximum ambient temperature of the transmitter (refer to Technical data, chapter 9).

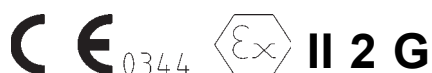
10.2 Intrinsically safe ATEX certified components (/KS1)

10.2.1 Technical data

Data of electronic transmitter type -E and -H :

The electronic transmitter is an intrinsically safe device. This device is certified for hazardous areas of zone 1 (category 2) und zone 2 (category 3). It is not homologated for zone 0 (category 1). The classifications in brackets are given according to EU-Regulation 94/9/EG (ATEX).

EC-Type Examination Certificate Nr.: PTB 96 ATEX 2160X
Identification in accordance with regulation 94/9/EG (ATEX) :



Type of protection	: Intrinsically safe EEx ia IIC T6
Ambient temperature	: -25°C ... +70°C
Safety relevant maximum values:	
Maximum voltage	: $U_i = 30 \text{ V}$
Maximum current (IIC)	: $I_i = 101 \text{ mA}$
Maximum current (IIB)	: $I_i = 253 \text{ mA}$
Maximum power	: $P_i = 1.4 \text{ W}$
Inner inductance	: $L_i = 0.15 \text{ mH}$
Inner capacity	: $C_i = 4.16 \text{ nF}$

Data of electronic transmitter type -G :

See Im 01R01B02-01E-E.

Data of limit switches :

The following table shows the maximum safety parameters for intrinsic safe limit switches according the certificates PTB 99 ATEX 2219X (Standard) and PTB 99 ATEX 2049X (Fail Safe).

	Standard /K1... /K3		Fail Safe /K6 ... /K10	
	Type 2	Type 3	Type 2	Type 3
$U_i \text{ [V]}$	16	16	16	16
$I_i \text{ [mA]}$	25	52	25	52
$P_i \text{ [mW]}$	64	169	64	169
$C_i \text{ [nF]}$	150	150	30	30
$L_i \text{ [μH]}$	150	150	100	100
max. ambient temp. [°C] for T6	66	45	66	45
max. ambient temp. [°C] for T5	81	60	81	60
max. ambient temp. [°C] for T4-T1	100	89	100	89

T100.EPS

The limit switches are also dust approved.

EC-Type Examination Certificate Nr.: ZELM 02 ATEX 0128X
Identification in accordance with regulation 94/9/EG (ATEX) :



Type of protection	: EEx iaD 20
Maximum surface temperature	: 108°C.

The dust explosion proof for the limit switches is only available if ordered without electronic transmitter (only with housing type "T").

Intrinsic safe power supply for the electronic transmitter :

The power supply for the electronic transmitter is an associated apparatus that may not be installed in the hazardous area, and it may not exceed the safety relevant maximum values for voltage, current and power of the electronic transmitters as specified above.

For example the type SINEAX B811 (option (U__)) according certificate PTB 97 ATEX 2083 can be used.

Intrinsic safe power supply for the limit switches :

The power supply (transmitter relay) for the limit switches is an associated apparatus that may not be installed in the hazardous area, and it may not exceed the safety relevant maximum values for voltage, current and power of the connected limit switch as specified above.

For example the type KFA6-SR2-Ex... (option (W2_)) according certificate PTB 00 ATEX 2081 (230V AC supply) or the type KFD2-SR2-Ex... (option (W4_)) according certificate PTB 00 ATEX 2080 (24V DC supply) can be used.

10.2.2 Installation

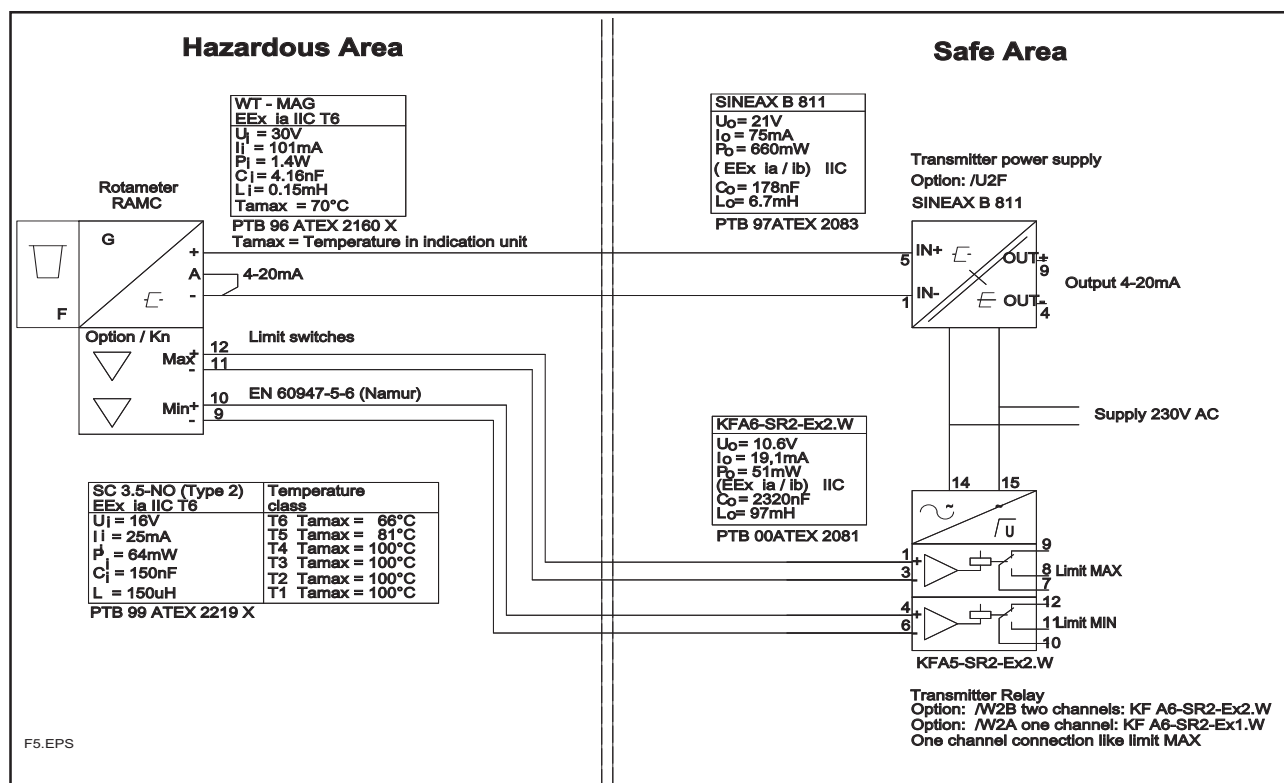


Fig. 10.1 Ex-Version according ATEX (Option /KS1) with electronic transmitter, power supply and limit switches with transmitter relay

10.2.3 Marking

Name plates of electronic transmitter :

Rota Yokogawa
D-79664 Wehr
WT-MAG Mat. No. 16-8040
Serial No. 0711001

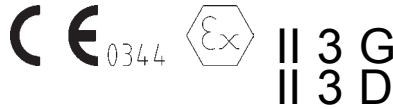
EEx ia IIC T6
PTB 96 ATEX 2160 X
U_i = 30V I_i = 101mA P_i = 1.4W
L_i = 0.15mH C_i = 4.16nF
CE 0344 Ex II 2G

10.3 Non incendive components for Category 3 (ATEX) (/KN1)

10.3.1 Technical data

RAMC with option /KN1 have an electronic transmitter and / or limit switches with protection type "n" (non incendive) for category 3G or dust proof for category 3D.

Identification:



Data of electronic transmitter :

The electronic transmitter is an apparatus with the type of protection "nL".

It can be mounted or installed in the hazardous areas of zone 2 (category 3).

The classification in brackets is given according to the new EU regulation 94/9/EG (ATEX).

This version is identically constructed as intrinsically safe (ia) version.

Type of protection : EEx nL IIC T6 X
 n = Non Incendive
 L = energy limited apparatus

Ambient temperature : $-25\text{ }^{\circ}\text{C} < T_a < 70\text{ }^{\circ}\text{C}$

Safety relevant maximum values :

Maximum voltage	: $U_i = 30\text{ V}$
Maximum current (IIC)	: $I_i = 152\text{mA}$
Maximum current (IIB)	: $I_i = 379\text{mA}$
Maximum power	: $P_i = 1.4\text{ W}$
Internal inductance	: $L_i = 0.15\text{ mH}$
Internal capacity	: $C_i = 4.16\text{ nF}$

Maximum surface temperature for dust application : 80°C

Data of limit switches :

The limit switches are apparatus with the type of protection "nL".

They can be mounted or installed in the hazardous areas of zone 2 (category 3).

The classification in brackets is given according to the new EU regulation 94/9/EG (ATEX).

This versions are identically constructed as the corresponding intrinsically safe (ia) versions.

Type of protection : EEx nL IIC T6 X
 n = Non Incendive
 L = energy limited apparatus

Ambient temperature : $-25\text{ }^{\circ}\text{C} < T_a < 100\text{ }^{\circ}\text{C}$ for SC3,5-N0 (Standard)
 $-40\text{ }^{\circ}\text{C} < T_a < 100\text{ }^{\circ}\text{C}$ for SJ3,5-SN / S1N (Fail safe)

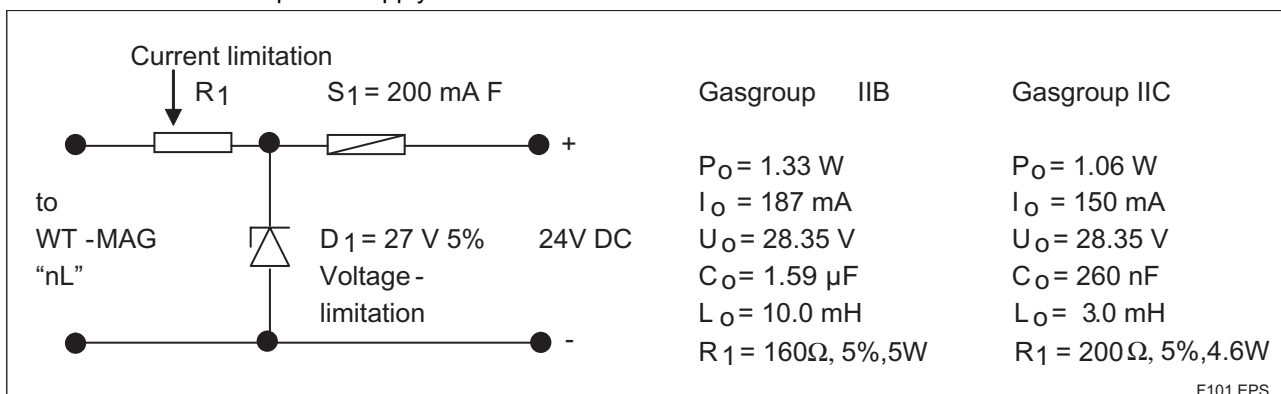
Maximum surface temperature for dust application : 112°C

Maximum safety parameters see table 10.1.

See also specification sheet from Pepperl & Fuchs for SC3,5-N0 (Standard) and SJ3,5-SN / S1N (Fail safe).

10.3.2 Installation

Protection circuit for a power supply to meet the maximum values of the electronic transmitter :



10.4 Intrinsically safe SAA (Australia) certified RAMC (/SS1)

The RAMC with or without electronic transmitter and / or with limit switches in fail-safe version (/K6 to /K10) is certified as intrinsic safe unit with SAA approval.

Certificate Nr.	: AUS Ex 3777X
Identification	: Ex ia IIC T5 (Tamb 65°C) IP54 AUS EX 3777X
Type of protection	: Intrinsically safe Ex ia
Group	: IIC
Temperature Class	: T5
Degree of Ingress Protection	: IP54
Hazardous Area	: Zone 0
Ambient temperature	: -25°C ... +65 °C (with limit switches -25°C ... +40 °C)
Safety relevant maximum values of electronic transmitter:	
Maximum voltage	: U_i = 30 V
Maximum current	: I_i = 186mA
Maximum power	: P_i = 1.4 W
Inner inductance	: L_i = 150 μ H
Inner capacity	: C_i = 60nF

Data of limit switches option /K6 to /K10 :

The following table shows the maximum safety parameters for intrinsic safe limit switches according the certificate AUS Ex 02.3839X :

	Fail Safe /K6 ... /K10	
	Type 2	Type 3
U_i [V]	16	16
I_i [mA]	25	52
P_i [mW]	64	169
C_i [nF]	30	30
L_i [μ H]	100	100
max. ambient temp. [°C] for T5	81	60
max. ambient temp. [°C] for T4-T1	100	89

T102.EPS

10.5 Intrinsically safe FM / CSA (USA + Canada) components (/FS1)

10.5.1 Technical data

Data of electronic transmitter (FM approval) :

Applicable Standards :

FM3600, FM3610, FM3611, FM3810

C22.2 No. 157, C22.2 No. 213

Type of protection :

intrinsic safe Cl. I, Div. 1, GP. A, B, C, D T6

intrinsic safe Cl. I, Zone 0, AEx ia IIC T6

nonincendive Cl. I, Div. 2, GP. A, B, C, D T6

Ambient temperature : -25°C ... +70°C

Maximum Entity and Nonincendive Field Wiring Parameters :

$V_i = 30V$

$I_i = 100mA$

$P_i = 1.4W$

$C_i = 40nF$

$L_i = 150\mu H$

Data of limit switches (CSA-approval):

The limit switches are intrinsically safe devices. They are certified by Pepperl & Fuchs for:

Intrinsically safe : Cl. I, Div. 1, GP. A, B, C, D

Cl. II, Div. 1, GP. E, F, G

Cl. III, Div. 1

or

Class I, Zone 0, Groups IIC T6 ($T_a=60^\circ C$)

Non incendive: Cl. I, Zone 2, GP. IIC, IIB, IIA ($T_a=50^\circ C$) T5

Cl. I, Div. 2, GP. A, B, C, D

Cl. II, Div. 1, GP. E, F, G

Cl. III, Div. 1 hazardous locations

Maximum Entity Field Wiring Parameters :

	Standard /K1... /K3	Fail Safe /K6 ... /K10
U_i [V]	16	16
I_i [mA]	25	25
P_i [mW]	34	34
C_i [nF]	150	30
L_i [μH]	150	100
max. ambient temp. [$^\circ C$]	60	60

T104.EPS

10.5.2 Installation

For installation see Control Drawings in 10.5.5



WARNING

-
- Installation should be in accordance with National Electrical Code, ANSI / NPFA70.
 - For intrinsic safe application a safety barrier or FM approved power supply must be used which meet the above mentioned entity parameters.
 - For nonincendive application the general purpose equipment must be FM approved which nonincendive field wiring which meet the above mentioned nonincendive field wiring parameters.
 - The FM Approved Hand Held Communicator may be connected at any point in the loop between the electronic transmitter and the Control Equipment.
-

10.5.3 Maintenance and Repair



WARNING

The instrument modification or part replacements by other than authorized representative of Rota Yokogawa is prohibited and will void the approval of FM Approvals.

10.5.4 Marking

Name plates of electronic transmitter :

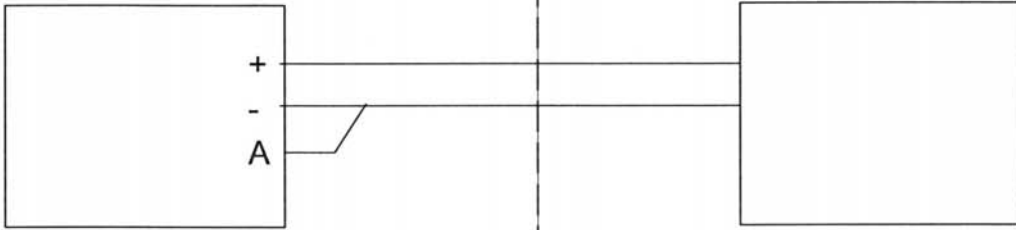
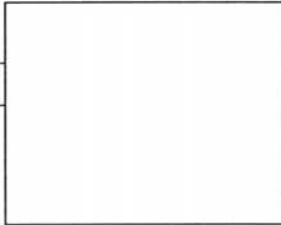
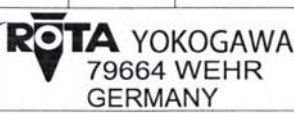
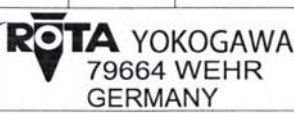
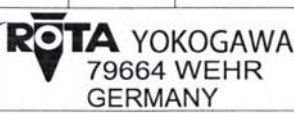
Rota Yokogawa
D-79664 Wehr
WT-MAG Mat. No. 16-8040
Serial No, 0711001

IS-Cl. I, Div. 1, GP. A, B, C, D T6
per dwg. 8160190
NI-Cl. I, Div. 2, GP. A, B, C, D T6
per dwg. 8160191
Cl. I, Zone 0, AEx ia IIC T6
Vmax=30V I_{max}=100mA P_{max}=1.4W
Cl=40nF Li=150μH Ta=-25°C to 70°C



10.5.5 Control Drawings

Electronic transmitter intrinsically safe

<h2 style="margin: 0;">Intrinsically Safe Entity</h2>																																																		
Hazardous (Classified) Location Class I, Division 1, Groups A, B, C, D, T6 or Class I, Zone 0, IIC T6			Nonhazardous Location																																															
<div style="border: 1px solid black; padding: 5px; margin: 5px;"> $V_{max} = 30V$ $I_{max} = 100mA$ $P_{max} = 1.4W$ $C_i \leq 40nF$ $L_i \leq 150\mu H$ $T_{amax} = 70^{\circ}C$ </div>			<div style="border: 1px solid black; padding: 5px; margin: 5px;"> $V_{oc} = 30V$ $I_{sc} = 100mA$ $P_o = 1.4W$ $C_a \geq 40nF + C_{cable}$ $L_a \geq 150\mu H + L_{cable}$ </div>																																															
WT-MAG			Associated Apparatus																																															
																																																		
<p>FM Entity approved associated apparatus necessary. Used in a configuration where associated apparatus V_{oc} or V_t does not exceed WT-MAG V_{max} and associated apparatus I_{sc} or I_t does not exceed WT-MAG I_{max}. C_i of WT-MAG plus capacitance of interconnecting wiring may not exceed associated apparatus C_a. L_i of WT-MAG plus inductance of interconnecting wiring may not exceed associated apparatus L_a.</p> <p>For guidance on installation see ANSI/ISA RP 12.06.01 "Installation of Intrinsically Safe Instruments Systems for Hazardous (Classified) Locations".</p> <p>The nonintrinsically safe terminals (power rail) must not be connected to any device which uses or generates more than 250V rms or d.c. unless it has been determined that the voltage has been adequately isolated.</p> <p>WARNING : Substitution of components may impair intrinsic safety. For installation, maintenance, or operation instructions see instruction manual.</p> <p>Install in accordance with the National Electrical Code NFPA 70 for US jurisdictions.</p> <p>Install in accordance with the Canadian Electrical Code C22.1-02 for Canada jurisdictions.</p>																																																		
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2"></td> <td colspan="2" style="text-align: center;">DATE</td> <td colspan="2" style="text-align: center;">NAME</td> <td colspan="2" rowspan="3" style="vertical-align: top; padding: 5px;"> TITEL: FM CONTROL DRAWING WT-MAG </td> </tr> <tr> <td colspan="2"></td> <td style="text-align: center;">DRAWN</td> <td style="text-align: center;">07.11.2000</td> <td colspan="2" style="text-align: center;">Amann</td> </tr> <tr> <td colspan="2"></td> <td style="text-align: center;">CHECKED</td> <td style="text-align: center;">07.11.2000</td> <td colspan="2" style="text-align: center;">Slotwinski</td> </tr> <tr> <td style="text-align: center;">c</td> <td></td> <td style="text-align: center;">08.09.06</td> <td style="text-align: center;">Rü</td> <td colspan="2" rowspan="3" style="text-align: center; vertical-align: middle;">  </td> <td colspan="2" rowspan="3" style="vertical-align: top; padding: 5px;"> DWG. No.: 8160190 </td> </tr> <tr> <td style="text-align: center;">b</td> <td></td> <td style="text-align: center;">09.06.06</td> <td style="text-align: center;">Rü</td> <td style="text-align: center;">HL</td> </tr> <tr> <td style="text-align: center;">a</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">Rev.</td> <td style="text-align: center;">UPDATE No.</td> <td style="text-align: center;">DATE</td> <td style="text-align: center;">EDITOR</td> <td style="text-align: center;">CHECKED</td> <td colspan="3"></td> </tr> </table>							DATE		NAME		TITEL: FM CONTROL DRAWING WT-MAG				DRAWN	07.11.2000	Amann				CHECKED	07.11.2000	Slotwinski		c		08.09.06	Rü			DWG. No.: 8160190		b		09.06.06	Rü	HL	a					Rev.	UPDATE No.	DATE	EDITOR	CHECKED			
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Rev.	UPDATE No.	DATE	EDITOR	CHECKED																																														

Electronic transmitter nonincendive

<h2 style="margin: 0;">Nonincendive</h2>																																																						
<u>Hazardous (Classified) Location</u> Class I, Division 2, Groups A, B, C, D, T6			<u>Nonhazardous Location</u>																																																			
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> $V_{max} = 30V$ $I_{max} = 100mA$ $P_{max} = 1.4W$ $C_i \leq 40nF$ $L_i \leq 150\mu H$ $T_{amax} = 70^{\circ}C$ </div>			<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> $V_{oc} = 30V$ $I_{sc} = 100mA$ $P_o = 1.4W$ $C_a \geq 40nF + C_{cable}$ $L_a \geq 150\mu H + L_{cable}$ </div>																																																			
WT-MAG <div style="border: 1px solid black; width: 150px; height: 100px; margin: 0 auto; position: relative;"> <div style="position: absolute; top: 5px; right: 5px; text-align: right;"> + - A </div> </div>			Associated Nonincendive field wiring apparatus <div style="border: 1px solid black; width: 150px; height: 100px; margin: 0 auto;"></div>																																																			
<p>The nonincendive field wiring circuit concept allows interconnections of nonincendive field wiring apparatus with associated nonincendive field wiring apparatus, using any of the wiring methods permitted for unclassified locations.</p> <p>$V_{max} \geq V_{oc}$ or V_t</p> <p>$C_a \geq C_i + C_{cable}$</p> <p>$L_a \geq L_i + L_{cable}$</p> <p>For this current controlled circuit the parameter I_{max} is not required and need not be aligned with parameter I_{sc} or I_t of the barrier or associated field wiring apparatus.</p> <p>For guidance on installation see ANSI/ISA RP 12.06.01 "Installation of Intrinsically Safe Instruments Systems for Hazardous (Classified) Locations".</p> <p>Install in accordance with the National Electrical Code NFPA 70 for US jurisdictions. Install in accordance with the Canadian Electrical Code C22.1-02 for Canada jurisdictions.</p> <p>WARNING : Substitution of components may impair intrinsic safety. For installation, maintenance, or operation instructions see instruction manual.</p>																																																						
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10. EXPLOSION PROTECTED TYPE INSTRUMENTS

Limit switches intrinsically safe

HAZARDOUS (CLASSIFIED) LOCATION

Class I, Division 1, Groups A, B, C, D
Class II, Division 1, Groups E, F, G
Class III, Division 1

or

Class I, Zone 0, Groups IIC T6 ($T_a = 60^{\circ}\text{C}$)

Pepperl+Fuchs, Inc. "NAMUR"
output proximity sensor. See Tables
for entity parameters

NONHAZARDOUS LOCATION

Any FM certified associated apparatus
with applicable division and group or
zone and group approval and with entity
parameters:

DIVISIONS

$V_{oc} \leq V_{max}$

$I_{sc} \leq I_{max}$

$C_a \geq C_i + C_{cable}$

$L_a \geq L_i + L_{cable}$

ZONES

$U_o \leq U_i$


$I_o \leq I_i$

$C_o \geq C_i + C_{cable}$

$L_o \geq L_i + L_{cable}$

Notes:

- For installation in a Division 1 hazardous (classified) location, the wiring must be in accordance with the National Electrical Code, NFPA 70, Article 504. For installation in a Zone 0 hazardous (classified) location, the wiring must be in accordance with the National Electrical Code, NFPA 70, Article 505. For additional information refer to ISA RP-12.6.
- The Entity Concept allows interconnection of intrinsically safe and associated apparatus not specifically examined in combination as a system when the approved values of V_{oc} (or U_o) and I_{sc} (or I_o) for the associated apparatus are less than or equal to V_{max} (or U_i) and I_{max} (or I_i) for the intrinsically safe apparatus and the approved values of C_a (or C_o) and L_a (or L_o) for the associated apparatus are greater than $C_i + C_{cable}$, $L_i + L_{cable}$, respectively for the intrinsically safe apparatus.
- Barriers shall not be connected to any device that uses or generates in excess of 250V rms or DC unless it has been determined that the voltage is adequately isolated from the barrier.
- Note associated apparatus with only Zone 1 approved connections limits the mounting of the sensors to Zone 1.
- 'a' in model number indicates option not affecting safety.
- NAMUR sensors are also nonincendive for Class I, Division 2, Groups A,B,C, and D; Class II, Division 1, Groups E,F, and G; Class III, Division 1; Class I, Zone 2, Groups IIC, IIB, IIA T5 hazardous (classified) locations and need not be connected to an associated apparatus when installed in accordance with Control Drawing 116-0155.

Dieses Dokument enthält sicherheitsrelevante Angaben. Es darf nicht ohne Absprache mit dem Normenfachmann geändert werden!					
This document contains safety -relevant information. It must not be altered without the authorization of the norm expert!					
Confidential according to ISO 16016		Only valid as long as released in EDM or with a valid production documentation!		scale: 1:1	date: 2003-Jul-01
 PEPPERL+FUCHS Twinsburg	Control Drawing	change notice 150- 0192	respons.	US.GMF	116-0165b
	NAMUR SENSORS – FM		approved	US.MPU	
			norm	US.WDB		sheet 1 of 7

Limit switches nonincendive

HAZARDOUS (CLASSIFIED) LOCATION	NON-HAZARDOUS LOCATION																																															
CLASS I, ZONE 2, GROUPS IIC, IIB, IIA ($T_a = 50^\circ\text{C}$) T5 CLASS I, DIVISION 2, GROUPS A, B, C and D CLASS II, DIVISION 1, GROUPS E, F and G CLASS III DIVISION 1 HAZARDOUS LOCATIONS																																																
PROXIMITY SENSORS																																																
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> Models C (Capacitive), I (Analog Inductive), M (Magnetic), N (Discrete Inductive), S (Slot), R (Ring) followed by a combination of numbers and letters. "-" dashes and/or "+" pluses may be included. </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> 2 5 6 7 </div>	<div style="display: flex; align-items: center; justify-content: center;"> <div style="display: flex; flex-direction: column; align-items: center;"> 3 1 9 </div> <div style="margin: 0 10px;"> </div> <div style="display: flex; flex-direction: column; align-items: center;"> 4 </div> </div> <div style="border: 1px solid black; padding: 10px; width: fit-content; margin: 10px auto;">Control Device</div>																																															
See Table 1. for sensors with nonincendive entity parameters. See Table 2. for sensors with exceptions.																																																
NOTES: <ol style="list-style-type: none"> ① Wiring methods must be in accordance with the National Electrical Code, ANSI/NFPA 70, Article 501-4(b) for Class I, Division 2; 502-4(a) for Class II, Division 1; 502-4(b) for Class II, Division 2; 503-3(a) for Class III, Division 1; 503-3(b) for Class III, Division 2. Zone 2 wiring requirements are equivalent to Division 2 wiring requirements. See manufacturer's instructions for connection of devices and electrical data. ② These proximity sensors are rated "Nonincendive". Proximity sensors without a provision for conduit connection (i.e. via a conduit adapter) or a sensor with a plastic base must be mounted in a tool secured enclosure meeting the requirements of ANSI/ISA 82. Alternatively, sensors in accordance with Table 1 may be wired according to nonincendive field wire methods (a conduit connection or enclosure is not needed). ③ Proximity sensors, conduit, enclosures, and exposed noncurrent-carrying metal parts must be grounded and bonded in accordance with the National Electrical Code, ANSI/NFPA 70, Article 250. ④ WARNING - DO NOT CONNECT OR DISCONNECT WHILE CIRCUIT IS LIVE UNLESS LOCATION IS KNOWN TO BE NONHAZARDOUS. ⑤ The relay outputs of a proximity sensor must be supplied by a nonincendive source. ⑥ Sensitivity adjustment should only be done when the area is known to be nonhazardous. ⑦ A temperature rating of T5 applies for all nonincendive proximity sensors. ⑧ The Entity Concept allows interconnection of nonincendive circuits with a nonincendive source when the approved values of V_{oc} and I_{sc} of the nonincendive source are less than or equal to V_{max} and I_{max} of the nonincendive circuit and the approved values of C_a and L_a for the nonincendive source are greater than $C_i + C_{cable}$ and $L_i + L_{cable}$, respectively, for the nonincendive circuit. ⑨ All Nonincendive sources must be FM approved. 																																																
TABLE 1 - NONINCENDIVE PARAMETERS ⑧ <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <thead> <tr> <th>MODEL NUMBER</th> <th>V_{max} (V)</th> <th>I_{max} (mA)</th> <th>C_i (UF)</th> <th>L_i (mH)</th> </tr> </thead> <tbody> <tr> <td>NJ2-12GM40-E2</td> <td>60.0</td> <td>200</td> <td>0</td> <td>0</td> </tr> <tr> <td>NJ5-18GM50-E2</td> <td>60.0</td> <td>200</td> <td>0</td> <td>0</td> </tr> </tbody> </table>	MODEL NUMBER	V_{max} (V)	I_{max} (mA)	C_i (UF)	L_i (mH)	NJ2-12GM40-E2	60.0	200	0	0	NJ5-18GM50-E2	60.0	200	0	0	TABLE 2 - EXCEPTIONS <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <thead> <tr> <th>MODEL NUMBER</th> <th>RESTRICTION</th> </tr> </thead> <tbody> <tr> <td>NBN3-F25-E8</td> <td>Do not use in a Class I, Division 1, Group E Hazardous Location</td> </tr> </tbody> </table>	MODEL NUMBER	RESTRICTION	NBN3-F25-E8	Do not use in a Class I, Division 1, Group E Hazardous Location																												
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10.6 Intrinsically safe NEPSI (China) certified RAMC (/NS1)

The RAMC with electronic transmitter (-E, -H) with or without limit switches is certified as intrinsic safe unit with NEPSI approval.

Certificate Nr. : GYJ05152
 Type of protection : Intrinsically safe Ex ia
 Group : IIC
 Temperature Class : T6
 Ambient temperature : -25°C ... +70 °C
 Safety relevant maximum values of electronic transmitter :
 Maximum voltage : $U_i = 30 \text{ V}$
 Maximum current : $I_i = 101 \text{ mA}$
 Maximum power : $P_i = 1.4 \text{ W}$
 Inner inductance : $L_i = 150 \text{ } \mu\text{H}$
 Inner capacity : $C_i = 4.16 \text{ nF}$

Data of limit switches option /K1 to /K10 :

The following table shows the maximum safety parameters for intrinsic safe limit switches according the certificate NEPSI GYJ03201X :

	Standard /K1... /K3		Fail Safe /K6 ... /K10	
	Type 2	Type 3	Type 2	Type 3
U_i [V]	16	16	16	16
I_i [mA]	25	52	25	52
P_i [mW]	64	169	64	169
C_i [nF]	150	150	50	50
L_i [μH]	150	150	250	250
max. ambient temp. [°C] for T6	66	45	66	45
max. ambient temp. [°C] for T5	81	60	81	60
max. ambient temp. [°C] for T4-T1	100	89	100	89

T103.EPS

10.7 Flame proof and dust proof ATEX certified RAMC (/KF1)

10.7.1 Technical data

Certificate :

IBExU 05 ATEX 1086

Flame proof :

EEx d IIC T1 ... T6 ; group II ; category 2G

Dust proof :




Group II ; category 1D

Ambient temperature :

-20°C to 60°C for category 2G / 2D

-20°C to 55°C for category 1D

Marking :




II 2G
II 1D TX

Temperature classification for gas application :

For RAMC with limit switch :

Temp. class	Max. ambient temperature [°C]	Max. process temperature [°C]
T6	60	85
T5	60	100
T4 ... T1	60	120

T1Ex.EPS

For RAMC with electronic transmitter :

Temp. class	Max. ambient temperature [°C]	Max. process temperature [°C]
T6	60	70
T5 ... T1	60 40	70 100

T2Ex.EPS

For RAMC with limit switch with extension (option /A16) :

Temp. class	Max. ambient temperature [°C]	Max. process temperature [°C]
T6	60	85
T5	60	100
T4	60	135
T3	60	200
T2	60	300
T1	60	370

T3Ex.EPS

For RAMC with electronic transmitter with extension (option /A16) :

Temp. class	Max. ambient temperature [°C]	Max. process temperature [°C]
T6	60	85
T5	60	100
T4	60	135
T3	60	200
T2 ... T1	60	300

T4Ex.EPS

For RAMC with limit switch with extension (option /A16) and isolation (rock wool between tube and back side of indicator) :

Temp. class	Max. ambient temperature [°C]	Max. process temperature [°C]
T6	60	85
T5	60	100
T4	60	135
T3	60	200
T2	60	300
T1	60	350

T5Ex.EPS

For RAMC with electronic transmitter with extension (option /A16) and isolation (rock wool between tube and back side of indicator) :

Temp. class	Max. ambient temperature [°C]	Max. process temperature [°C]
T6	60	85
T5	60	100
T4	60	135
T3	60 40	150 200
T2 ... T1	60 40	150 250

T6Ex.EPS

If both, electronic transmitter and limit switch(es), are installed the unfavourable process temperature according to the respective ambient temperature and temperature class must be selected.

Degree of protection : IP66 / 67

Max. surface temperature for dust application : corresponding to process temperature

10.7.2 Installation

The electrical connections to the electronic transmitter and to the limit switches must be made via suitable cable glands and / or conduit systems that satisfy the requirements of EN 50018 or EN 60079-1 sections 13.1 and 13.2 and for which a separate test certificate is available. The cables, cable glands and stopping plugs must be specified for an ambient temperature of 100°C. Cable glands and entry fittings (screwed conduit entries) as well as stopping plugs of simple design may not be used.

On connection of the RAMC /KF1 using a conduit entry approved for the purpose, the associated sealing facility must be arranged directly on the housing.

Unused openings shall be closed with certified stopping plugs in type of protection flame proof enclosure "d" (100°C). Secure cable glands, stopping plugs and the safety screw for the cover against twisting.

For installation in areas with combustible dust EN50281-1-2 must be considered.



CAUTION

The RAMC with option /KF1 shall be connected to the local equipotential grounding system. Therefore a grounding screw is available outside on the indicator housing and inside the indicator .

The electronic transmitter and the limit switches shall be wired as described in chapter 3.2.

10.7.3 Operation

If the cover of the indicator unit has to be opened, following instructions must be followed.



CAUTION

1. Switch off the power supply.
 2. Wait 2 minutes after power is turned off before opening the covers.
 3. The cover is fixed with a special screw.
 4. Be sure to lock the cover with special screw after tightening the cover.
 5. Before starting the operation again, be sure to lock the cover with the locking screw.
 6. Users are prohibited from making any modifications of specifications or physical configuration, such as adding or changing the configuration of external wiring ports.
-



WARNING

The instrument modification or parts replacement by other than authorized representatives of YOKOGAWA is prohibited and will void the certification.



WARNING

If the window of the cover is damaged the RAMC must be set out of operation..

11. Instructions for PED

The units are produced according the determinations of directive 97/23/EG (directive for Pressure – Equipment / PED).

The units are classified as pipe according item 3, number 1, 3. letter, a) first dash or according diagramm 6 after appendix II :

- Classification as pipe
- For Fluid Group 1 and 2 (article 9 chapter (2))
- Medium fluid and gas

The basic safety requests (for design, production and testing) for all units according to category I to III are generally determined for the requests of category III.

The units, which are not excluded by PED article 3 paragraph 3, are checked by a conformity-valuation –methode according appendix III 'module H'.

The complete quality assurance system according PED appendix III module H was certified by the notified body :

Lloyd's Register Nederland B.V.; Weena-Zuid 170; NL-3012 NC Rotterdam

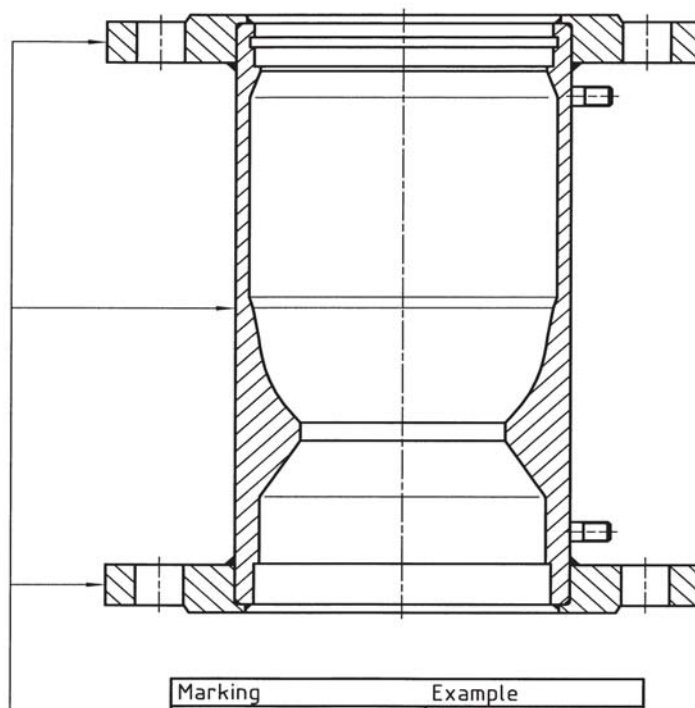
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IMPORTANT

The user is responsible for the use of our flowmeters regarding suitability and use as agreed.

PED-Data on RAMC



Marking	Example
Cone	e.g. 82
Material	1.4404 / AISI 316L
Flowdirection	←
made by	ROTA YOKOGAWA D-79664 Wehr
CE marking	CE 0343
Charge	e.g. ch. 123456
Commissioning No.	e.g. Kom.Nr.20000
nominal size	e.g. DN 100
nominal pressure	e.g. PN 40
year of production	e.g. 2002
temperature data	e.g. TS-180°C/+370 see Instruction Manual

11. INSTRUCTIONS FOR PED

Dependence of the permissible max.effective pressure of the operating temperature:

The pressure relevant temperature limits of the RAMC are: -180 to 370°C for units made from 1.4571/1.4404, -80 to 130°C for units made from PTFE.

These limits are reduced by metrological boundary conditions. (see temperature curves and table)

Process connection			Medium temperature									
			-180°C	RT (20°C)	50°C	100°C	150°C	200°C	250°C	300°C	350°C	370°C
A1	Flange ASME 150lbs		15.9 bar	15.9 bar	15.3 bar	13.3 bar	12bar	11.2 bar	10.5 bar	10 bar	8.4 bar	7.4 bar
A2	Flange ASME 300lbs		41.4 bar	41.4 bar	40bar	34.8 bar	31.4 bar	29.2 bar	27.5bar	26,1 bar	25.1 bar	24.8bar
A3	Flange ASME 600lbs		82.7 bar	82.7 bar	80 bar	69.6 bar	62.8 bar	58.3 bar	54.9bar	52.1 bar	50.1 bar	49.5bar
D2	Flange EN PN16		16 bar	16 bar	15.6 bar	14.2 bar	12.8 bar	11.7 bar	10.9 bar	10.3 bar	9.9 bar	9.6 bar
D4	Flange EN PN40		40 bar	40 bar	39.1 bar	35.6 bar	32 bar	29.3 bar	27.2 bar	25.8 bar	24.7 bar	24 bar
D5	Flange EN PN63		63 bar	63 bar	61.6 bar	56 bar	50.4. bar	46.2 bar	42.8 bar	40.6 bar	38.9 bar	37.8bar
D6	Flange EN PN100		100 bar	100 bar	97.8 bar	88.9 bar	80 bar	73.3 bar	68 bar	64.4 bar	61.8 bar	60 bar
R4/T4	Internal thread	RAMC01..	25 bar	25 bar	25 bar	25 bar	20 bar	20 bar	20 bar	20 bar	-----	-----
R4/T4	Internal thread	RAMC23..	25 bar	25 bar	25 bar	25 bar	20 bar	20 bar	20 bar	20 bar	-----	-----
R4/T4	Internal thread	RAMC02..	16 bar	16 bar	16 bar	16 bar	16 bar	16 bar	16 bar	16 bar	-----	-----
R4/T4	Internal thread	RAMC03..	16 bar	16 bar	16 bar	16 bar	16 bar	16 bar	16 bar	16 bar	-----	-----
R4/T4	Internal thread	RAMC05..	10 bar	10 bar	10 bar	10 bar	10 bar	10 bar	10 bar	10 bar	-----	-----
R4/T4	Internal thread	RAMC06..	10 bar	10 bar	10 bar	10 bar	10 bar	10 bar	10 bar	10 bar	-----	-----
G6/T6	Internal thread	RAMC01..	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	-----	-----
G6/T6	Internal thread	RAMC23..	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	-----	-----
G6/T6	Internal thread	RAMC02..	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	-----	-----
G6/T6	Internal thread	RAMC03..	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	-----	-----
G6/T6	Internal thread	RAMC06..	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	-----	-----
S2	Pipe connection DIN 11851	RAMC02..		40 bar	see corresponding standard for the connection							
S2	Pipe connection DIN 11851	RAMC05..		25 bar								
S2	Pipe connection DIN 11851	RAMC06..		25 bar								
S2	Pipe connection DIN 11851	RAMC08..		25 bar								
S2	Pipe connection DIN 11851	RAMC10..		25 bar								
S2	Pipe connection DIN 11851	RAMC12..		16 bar								
S4	Clamp	RAMC02..		16 bar	see corresponding standard for the connection							
S4	Clamp	RAMC03..		16 bar								
S4	Clamp	RAMC04..		16 bar								
S4	Clamp	RAMC05..		16 bar								
S4	Clamp	RAMC06..		10 bar								
S4	Clamp	RAMC08..		10 bar								
S4	Clamp	RAMC10..		10 bar								
S5	Rosista Flange	RAMC02..		10 bar	see corresponding standard for the connection							
S5	Rosista Flange	RAMC04..		10 bar								

Change of the process connections:

The flanges change from

DIN 2526 facing form C into
DIN-EN 1092-1 facing form B1

The connection measurements of the flanges remain the same. That means that DIN and EN fit one to another.

The facing of the flanges has changed. This may effect the gaskets.

Operation reductions:

The operator is responsible, that no corrosion and/or erosion is caused by the medium, which reduces the safety of the unit as pressure vessel. In addition one has to take care, that no decomposition of unstable fluids may happen.

Corrosion and erosion make the unit fail and can lead to the endangering of persons and facilities. If corrosion and erosion are possible, this has to be checked by control at the removed unit.

Note	In the following only the dangers, which may appear with the pressure load of the unit, are considered. In connection with the accompanying electronics additional risks may appear, which requires corresponding precautions. Also precautions to reach the measuring precision are not considered.		
	Endangering by:	Description	Remarks
Medium	Surface temperature	Surface temperature is hot in case of high process temperature. It is the sole responsibility of the user to establish proper means to prevent touching of the measuring tube.	
	max. / min. process temperature	see chapter 9.3 and 11	
	max. process pressure	see chapter 9.3 and 11	
	Tightness of the wetted, PED relevant volume	A factory test is done before delivery	
	Corrosion and erosion effects	It is the sole responsibility of the user to select proper wetted materials for the medium intended to use (see chapter 11)	
	Life time evaluation	Experience shows that the lifetime of the measuring tube within the allowed operation conditions is more than 10 years.	Without erosion and corrosion.
	Temperature shock	Permanent temperature cycles of more than 100°C temp. difference have to be avoided. Tube failure can occur because of material wearing.	
	Instable fluids	If instable fluids are transported it is the sole responsibility of the user that in case of decomposition the design limits are not exceeded. (see chapter 11)	
Installation	Process pressure / temp. relation	see chapter 11	
	Piping and support forces	see chapter 2.3 and 3.1	
	Choice of gaskets and pre-stress of the process connections	It is the sole responsibility of the user to select suitable gaskets and to screw the process connections with the necessary torques.	Refer to EN 1591 -1
	Use of closing and openings	see chapter 2.3	
	Pressure shock, water hammer and pressure surges	Dynamical exceeding of the given max. pressure at process temp. has to be avoided.	Water hammer can lead to tube failures.
	Filling and emptying of the pipe work	The measuring tube is part of a pipe work. The pipe work has to be filled slowly (see chapter 4.2)	
	Disposal, cleaning and return	see chapter 1.1	
	Flow direction of the unit	upwards	
	Installation position of the unit	see chapter 2.2 and 3.1	A wrong installation position gives only measuring disturbances
	Pipe stress by weight of the instrument	see chapter 9.4, table 9.6 through 9.10	
Outer influence	Permitted ambient conditions (temperature, humidity)	see chapter 2.2 and 9.3	
	External fire	External fire can result in - Rise in pressure by temperature - Damage of gaskets It is in the sole responsibility of the user to implement suitable means to prevent large damage in the case of fire.	The instrument itself does not contain flammable materials.
	Earthquake resistance	- Damage of the mounting screws	Check by user

T111.EPS

11. INSTRUCTIONS FOR PED

The following usages of the instruments are not permitted:

- use as climbing aid (e.g. during assembling work on pipe system)
- use as support for external load (e.g. support for piping) or tray surface for heavy tools (e.g. during piping work)
- Material removal by any kind of machining (e.g. drilling, sawing etc.)
- Painting of the name-plate/scale
- Brazing or welding of parts to the instrument
- Any repair, modification or supplements or the installation of spare-parts is only permitted if it is done in accordance to this instruction manual. Other work must be agreed by YOKOGAWA beforehand. YOKOGAWA will not take over any liability for damages caused by unauthorised work on the instrument or prohibited usage of the instrument.

YOKOGAWA HEADQUARTERS
9-32, Nakacho 2-chome,
Musashinoshi
Tokyo 180
Japan
Tel. (81)-422-52-5535
Fax (81)-422-55-1202
E-mail: webinfo@mls.yokogawa.co.jp
www.yokogawa.com

YOKOGAWA EUROPE B.V.
Databankweg 20
3821 AL AMERSFOORT
The Netherlands
Tel. +31-33-4641 611
Fax +31-33-4641 610
E-mail: info@nl.yokogawa.com
www.yokogawa.com/eu

YOKOGAWA CORPORATION OF AMERICA
2 Dart Road
Newnan GA 30265
United States
Tel. (1)-770-253-7000
Fax (1)-770-251-2088
E-mail: info@yca.com
www.yca.com

YOKOGAWA ELECTRIC ASIA Pte. Ltd.
5 Bedok South Road
Singapore 469270
Singapore
Tel. (65)-241-9933
Fax (65)-241-2606
E-mail: webinfo@yas.com.sg
www.yokogawa.com.sg

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YOKOGAWA ◆

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